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COMMERCIAL FISHERIES REVIEW

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COMMERCIAL FISHERIES REVIEW

A REVIEW OF DEVELOPMENTS AND NEWS OF THE FISHERY INDUSTRIES
PREPARED IN THE DIVISION OF COMMERCIAL FISHERIES

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Applications for COMMERCIAL FISHERIES REVIEW, which is mailed free to members of the fishery industries and allied interests, should be addressed to the Director, Fish and Wildlife Service United States Department of the Interior, Washington, 25, D.C.

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Cover: "Racing to make their sets at the turn of the tide."

Sockeye salmon purse seiners off San Juan Island, Puget Sound Lime Kiln Light at night.

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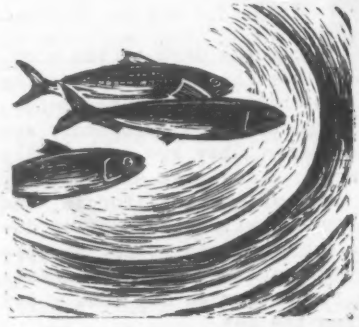
COMMERCIAL FISHERIES REVIEW

January 1947 Washington 25, D.C. Vol. 9, No. 1

THE LOCATION OF SARDINE SCHOOLS BY SUPER-SONIC ECHO-RANGING

By Osgood R. Smith*



During the California sardine season from August 1, 1944 to February 15, 1945, the Navy cooperated with the Fish and Wildlife Service in conducting experiments to determine the feasibility of using super-sonic echo-ranging equipment to locate sardine schools, for the purpose of increasing the catch of a much needed food during the war.

The echo-ranger is called "sonar" in this country and "asdic" in Great Britain. It should not be confused with radar. The echo principle is the same, but wave frequencies used in radar cannot be used under water.

The sonar, used by the Navy to locate submarines or other under-water objects, operates on much the same general principles as super-sonic echo sounders already in common use on large fishing vessels and used extensively by the Coast and Geodetic Survey for accurately charting submarine topography.

Various types of echo sounders, their uses, and the physics of sound waves in water are thoroughly described in the Hydrographic Manual, U. S. Coast and Geodetic Survey, Special Publication No. 143, Revised (1942).

Super-sonic impulses have less range than sonic impulses, such as those arising from explosions or hammering, but they are more directional. The wave frequency used in echo-ranging is a compromise between the two desirable physical qualities of range and directability.

The ability of high frequency echo sounders to locate fish schools by echo has been demonstrated, notably by the Norwegian research vessel Johan Hjort, that located cod shoals over 10 years ago (O. Sund, Nature, 135 (3423), 953, June 1935) and more recently by experiments on herring schools off British Columbia (Tester, A. L., Fisheries Research Board of Canada, Bull. LXIII, 1943).

The echo-ranging equipment used by the Navy can locate fish schools in much the same way as echo-sounding equipment, but in the case of the former, the beam of high frequency impulses is directed horizontally through the water instead of straight down. Consequently, a vessel scouting with echo-ranging equipment can explore a much larger area. A super-sonic beam may be aimed much like a searchlight, and in this way the bearing and the approximate size of a reflecting object may be measured and any movement detected. The range is derived from the echo-

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time. As with standard echo sounders, the echo from a non-rigid surface, such as fish schools, kelp beds, or a mud bottom, is less sharp than the echo from a hard surface such as rocks, or a ship's hull. This difference can be recognized by either visible or audible electronic signals, or both.

The velocity of sound waves in water varies with the physical properties of the water, the two most important being temperature and pressure. The speed of sound increases with temperature and also with pressure, but the effect of temperature generally dominates in the upper water layers. Hence, a horizontal beam of sound waves may be refracted downward by a sharp temperature gradient or thermocline, sometimes producing echoes from the bottom. A "wall" of different temperature water may also reflect some of the sound waves and produce a faint echo. Both these types of echoes can be distinguished from echoes of fish schools, but they may cause interference or restrict the effective range.

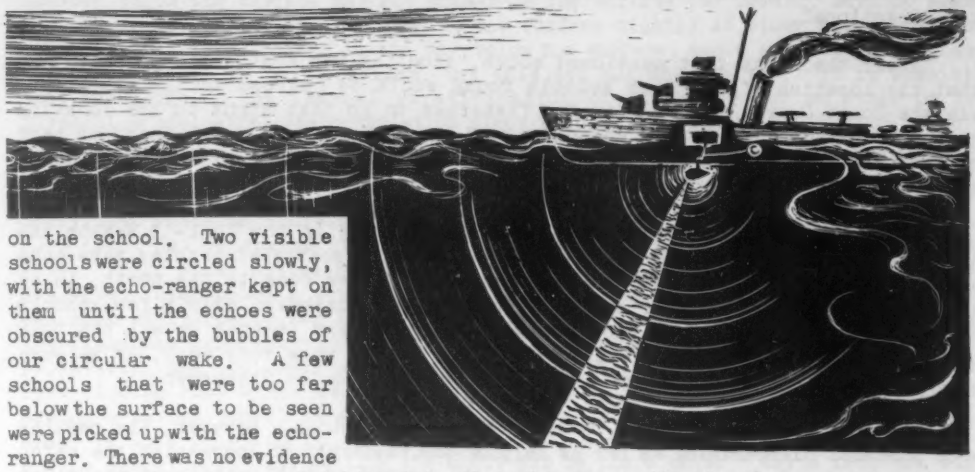
Sardines are caught off the California coast during the dark of the moon, when the dense schools may be found by the luminescent patches they make in the water. The school is circled with a great quarter-mile-long net, or purse seine, and it may yield 150 to 200 tons of sardines, or even more. Sardine schools are apt to occur in groups unevenly distributed along the coast. They are not usually visible at the surface during daylight off California. Anchovies are the only other species commonly occurring in large schools off northern California, and they considerably complicate fishing, as well as scouting with echo-ranging devices, because they are a nuisance and a liability to the fishermen. They may become gilled in the nets by the ton, and may tear or take to the bottom thousands of dollars of netting in one unlucky "set." Even a few anchovies may mean a day of hard work and lost fishing time to remove them from the net.

To test the practicability of aiding the sardine fleet during the past season, Dr. L. A. Walford made two scouting trips on Navy PC's (175 feet submarine chasers) patrolling off San Francisco, and the author went out 12 times. We scouted north to Bodega Bay, west of the Farallon Islands, or south as far as Pt. Montara; the length of each trip being limited by the time that the ship could be spared from her wartime duties.

The first three trips were inconclusive. Sonar contacts were secured during only one of them, and these were too indistinct to be definitely identified as fish.

On the fourth trip (August 8) we obtained many echoes east and northeast of the Farallon Islands, but most of them were very faint, and we could not maintain contact long enough to make a good test. However, salmon caught by trolling from the PC had fresh sardines in them, and also the sardine fleet made catches on the next few nights only a few miles farther south.

On the night of August 16, echo-ranging was tried in the locality where the fleet was fishing. This was done to test the equipment in an area where the schools could be seen by their luminescence. As we approached the fishing fleet of some 60 vessels southeast of the Farallones, sonar contacts became more and more frequent and they were found all around the ship after we were among the fishing boats. Several times an echo was located 700 to 1200 yards dead ahead, and as we approached the spot a typical luminescent sardine school could be seen. Other schools were located with the echo-ranger off the sides of the vessel and seen immediately after. A few small schools were seen first, while the echo-ranger was exploring in another direction, and then the echo was picked up by echo-ranging

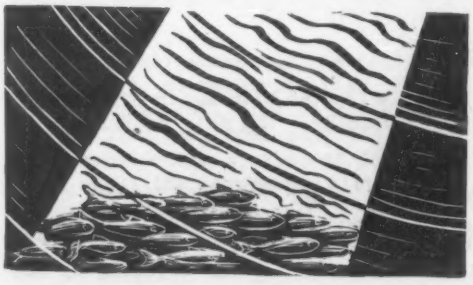


on the school. Two visible schools were circled slowly, with the echo-ranger kept on them until the echoes were obscured by the bubbles of our circular wake. A few schools that were too far below the surface to be seen were picked up with the echo-ranger. There was no evidence that the fish were more frightened by the echo-ranger than by the approach of any vessel.

After gaining confidence on this night's scouting trip, we devised a set of criteria for the identification of fish schools. These were: (1) the character and tone of the echo which was described by the sonar operator as "mushy," non-metallic, and much less distinct than the echo received from a submarine or wreck, (2) the size of the echoing surfaces, which were usually larger than a submarine, a wreck, or a whale and yet more distinct and sharply defined than an echo from a sharp temperature gradient or from the bottom, (3) variations in the tone and intensity of the echoes, such as might be caused by the fish heading in different directions and thus offering more or less echoing surface, and especially, (4) by movement of the "target," often in an erratic and irregular manner.

Echo-ranging was also tried on whales, a submarine, schools of porpoises, ships and their wakes, and mine sweeping paravanes for comparison with fish schools. On one occasion, echoes were received from the bottom, in a complete circle about the ship at one range. This apparently was due to a sharp temperature gradient bending the sound path downward. The echoes from all these could be distinguished from fish school echoes.

In addition, each moving "target" made characteristic super-sonic "noises," which could be detected with the sonar listening device. Porpoises clatter like a herd of horses on a wooden bridge, and a school of fish makes a strange conglomeration of clicking, tapping, fluttering, and rumbling noises. One sailor suggested that the fish sounded like activity in a machine shop. It might even be possible to distinguish different kinds of fish by their noises, but this could not be tested. The direction of noises from fish schools checked roughly with the direction of the echoes, though the bearings could not be measured quite as accurately. There are also various "water noises" that cause interference in rough weather or at



high speeds, but these are much like ordinary audible water noises, and they are not directional.

After the night test mentioned above, scouting was done during daylight so that the location of any fish schools found could be radioed to the fishermen, via the Coast Guard, in time for the fishermen to go that night to the location given. Each fishing boat was checked out of the harbor by the Coast Guard as part of their wartime control, and the messages we sent were relayed by the Coast Guard to each boat as it checked out.

It so happened that most of the sardine fishing in the 1944-45 season was done well to the south of San Francisco. Only a few scattered catches were made north of that port. Most of the scouting by PC's was done to the north, in an effort to locate fish nearer port. On most trips northward only a few schools were located. Targets that probably were schools were located on all but four out of the 14 scouting trips made, but if the echoes were very weak, or we were unable to maintain contacts, we did not report them to the fishermen.

Fish schools were reported by radio on five occasions. However, the results were somewhat discouraging as far as helping the fishermen or increasing the catch was concerned. Once, stormy weather and the period of full moon kept the fleet in port. On two occasions the fleet, quite understandably, ignored our reports of fish to the north and all went south, because fish had been caught there the previous night. On one occasion, during the week of the full moon, when the fleet was in port, we scouted south of San Francisco one day and north the next. We found many schools to the south and only a few northward. This situation was reported and all of the fleet went south the following night and made good catches. This checked neatly with our sonar scouting, but as the fleet usually had been fishing to the south during the season, we could not claim to have led the boats to the fish.

On December 3, we located a large group of schools north and west of the Farallon Islands. This was by far the largest group of schools or shoal found to the north, and they met all the criteria of fish schools mentioned above. Twenty-one definite schools were located in an hour and 26 minutes, or about one every 4 minutes, without deviating from our course. These were reported by radio, but only one boat investigated the report. This boat scouted the area on following nights without seeing any fish. It is possible that we located schools of fish that did not come to the surface. It is also possible that the fleet would have found fish in this area sooner if they had scouted it more thoroughly. At any rate, on the night of December 15, 12 days later, the fleet made good catches between Pt. Reyes and the Farallon Islands for the first time in 2 months. After the fishermen had located this school-group, they apparently concentrated on the same fish until December 21, the end of the dark, following them as they moved south as far as Santa Cruz.

DISCUSSION

The tests demonstrated that fish schools can be located with super-sonic echo-ranging equipment, just as they can with an echo sounder. The main difference is that the echo-ranger covers a wider area.

Fish schools below the surface were located on a number of occasions and their positions radioed to the fishing fleet. In most cases the fishermen ignored the report and proceeded elsewhere, where fish had been caught previously, or if a few boats did go to the area indicated they failed to find fish. The scouting by the

fishermen was not thorough enough to be conclusive, but it would appear that schools located below the surface may not appear on the surface for several days or weeks in some areas, while they may come to the surface nightly in other areas. It was our hope that fish located in the day, below the surface, would come to the surface and be available to the fishermen, but this did not materialize. It is possible that knowledge on the thermal stratification of the water, or on other of its physical or biological characteristics might enable one to determine whether schools found at subsurface levels in the daytime would rise to the surface at night.

It was not practical to have the Navy vessel remain in one spot and direct individual boats to individual schools for "blind sets" principally because the PC's could not be spared long enough from their wartime patrol off the Golden Gate. Their other duties restricted both the time and the extent of our scouting and often interrupted a cruise unexpectedly. Faced with this situation, it did not seem advisable to try to break down the natural skepticism of the fishermen. The fishermen generally preferred to scout in areas where fish had been caught previously, and they were afraid of the financial risk or days of hard work and lost fishing that might result from catching anchovies. Furthermore, setting around a moving school is not easy, even when it can be seen, so to set blindly might be like shooting in the dark. If they miss the fish, the men are in for 2 or 3 hours' work just getting the empty net on board again. Aside from the difficulty of circling an unseen and moving school, the fish might easily escape by going out under the net before the purse line has gathered the bottom together, as a draw string closes a bag. Fish are very often lost this way even when the school is found at the surface, so if a school is already 15 or 20 fathoms below the surface, it might easily escape under a net 25 or 30 fathoms deep.

Guiding individual boats would also have raised the problem of distributing any benefits fairly among all fishermen, and might have led to accusations of favoritism. The Navy had been faced with this problem in fish scouting from blimps, and several officers expressed a desire to avoid such a situation.

Taking all aspects of sonar scouting, as carried on during these experiments, it was concluded that the Navy scouting vessel did not increase the efficiency of the sardine fleet enough to be justifiable as a war measure, and the work was discontinued.

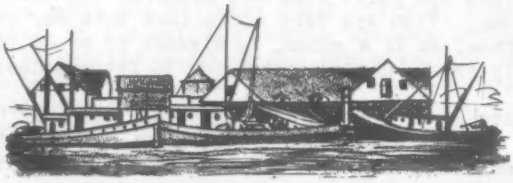
The experiments demonstrated, however, that sonar can locate schools of fish under certain conditions, and sonar may become a valuable tool for commercial fisheries or fisheries research, or both. If echo-ranging devices can be built small enough and cheap enough to be installed on fishing vessels, they might be of considerable value in some cases, especially under conditions of poor visibility. It should be possible to use sonar to locate subsurface schools, and watch their movements so fishing boats could be on hand when the fish come up. In some types of fisheries, sonar might be used to make "blind sets" on subsurface schools.

Probably sonar and listening devices could serve the fishing interests best indirectly, as research aids. For this purpose they should be installed on vessels devoted full time to research on schooling fishes. In this way, if used in conjunction with some sampling method, such as jigs, bombs, or small gill nets, to determine the species of fish located, it would be possible to learn a great deal about the movements, distribution, and perhaps spawning of fish like sardines. Such exploring would help to fill a great gap in the knowledge of both scientists and fishermen. This is especially needed for the California sardine. It occurs

sporadically all the way from Alaska to Baja California, yet most of our present knowledge is derived from waters near a few widely separated fishing ports.

Newer types of echo-ranging and also listening devices, designed for soft objects instead of submarines, probably would be even more effective than the ones tested. The newer ones should also be easier to operate and maintain, according to one electronic engineer. Therefore, super-sonic equipment for fisheries investigation should be modern and, if possible, specially adjusted for the purpose.

PACIFIC COAST SARDINE CANNING



The sardine canning industry of the Pacific Coast utilizes as raw material the California sardine, which is closely related to the species canned as sardine in France, Portugal, and Spain. It is known as pilchard in the British Empire. The range of this fish on the Pacific Coast extends from Vancouver Island south to the Gulf of Lower California. The canning industry is centered at San Diego, San Pedro, Monterey, and in San Francisco Bay, California. While the fish are taken in quantity off Coos Bay, Columbia River, and Grays Harbor area of the Oregon-Washington coast, they are utilized almost entirely for reduction purposes. Some are canned in Astoria, Oregon, and a small quantity is canned in 1-pound tall cans in British Columbia as pilchards. With these exceptions, the sardine-canning industry is located in California. The fishing area covers a radius of approximately 150 miles around each port.

The season when sardines may be taken for canning or reduction purposes varies with the respective areas and is based on the time of year when they are in prime condition. At present, sardines may be taken for packing from August 1 to February 15 in the northern California or the San Francisco and Monterey areas, and in the San Pedro-San Diego district from November 1 to March 30, inclusive.

--Fishery Leaflet No. 81

BACTERIOLOGICAL STUDIES OF OYSTER CONDITIONING

By Leslie A. Sandholzer* and Cecelia R. Buckner**

ABSTRACT

Preliminary experiments have been made to determine the best methods for conditioning oysters to rid them of coliform bacteria. When kept in tanks of sea water, oysters did not improve in sanitary quality even when the water was chlorinated. At chlorine concentrations sufficiently high to kill the coliform bacteria, the oysters did not pump the water through their systems. At lower concentrations, failure to eliminate the coliforms was due to recontamination because of the inability to get rid of these bacteria in the water in the tank.

When oysters were kept in flowing, clean water which was free of chlorine and coliform bacteria, the total bacterial count was reduced rapidly, and the coliform bacteria were completely eliminated within a very short time. In some instances oysters were coliform-free within 30 minutes when treated in this manner.

Although much more work is necessary to determine ideal conditions for eliminating coliform bacteria from oysters on a commercial scale, it appears that a system which employs flowing water probably will be the most satisfactory.

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The problem of utilizing shellfish from areas which are known to be only slightly polluted with domestic sewage has been considered by sanitarians for some time. A large supply of oysters is available from such areas providing they can be rendered safe for human consumption. The possibility of ridding oysters of undesirable bacteria by conditioning them in chlorinated water has been given some attention (Galtsoff, 1946, and U. S. Public Health Service, 1944). There are other methods which might be used, however; and this report describes bacteriological studies of oyster conditioning by the use of flowing water and in tanks containing sea water with low concentrations of chlorine and with chlorine-free water.

A recommended method of oyster conditioning requires that the oysters be held in tanks containing chlorinated sea water. The required initial free chlorine content is not less than 0.5 p.p.m., and a residual of not less than 0.05 p.p.m. must be maintained throughout a 48-hour period of conditioning. In order to test the effectiveness of this procedure, two types of bacteriological investigations were instituted by the U. S. Fish and Wildlife Service. The first was designed to determine the ability of the oyster to rid itself of coliform bacteria without chlorination. The second was to evalu-

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ate chlorination per se as an effective means of freeing oysters of these micro-organisms. This is a report of the experimental findings.

Bacteriological investigations were made on oysters maintained in flowing water in a Galtsoff device whereby the oyster effluent could be readily cultured. When exposed to large quantities of coliform bacteria, the oysters apparently managed to rid themselves of these micro-organisms within a very short time, usually becoming coliform-free within 30 minutes.

When stored in an aquarium with water containing the maximum concentrations of free chlorine (0.03 p.p.m.) which permitted the normal functioning of the oysters, coliform bacteria were retained over a period of 48 hours, and there was no apparent reduction in the total bacterial content of the shellfish.

The findings indicate that the described method of conditioning oysters by chlorination is probably ineffective.

In 1915, Johnstone published the results of his investigations of mussel purification. He found that, when polluted mussels were placed in 10-liter tanks filled with sea water flowing at the rate of one liter every 5 minutes, the bacterial content was reduced 90 percent in 2 days. The same results obtained when polluted mussels were transferred to unpolluted water and held over a period of six tides. He also reported that sea water containing 1 p.p.m. of free chlorine was effective in freeing mussels of sewage bacteria. He recommended the use of 5 p.p.m. in practice, since this amount of chlorine did not appear to interfere with the normal functioning of the mussels. At this concentration, 3 days were required for the elimination of the coliform bacteria. He concluded that exposure to running sea water or storage in chlorinated sea water would remove 90 percent of the objectionable bacteria. He postulated a twofold mechanism for chlorination:

> First, it renders the sea water sterile, and the sterile sea water mechanically removes the bacteria;
>
> Second, the free chlorine destroys the bacteria enmeshed within the shellfish.

Wells (1920) observed that food particles are eliminated within 5 hours after they have been filtered by the gills of the oyster. He concluded that, if conditions are maintained so that the oyster itself removes its own pollution and no further contamination occurs, a slightly polluted oyster can cleanse itself within 24 hours. Later (1929) he stated that continual spraying of oysters with chlorinated sea water offered security of the public health. His method required the maintenance of an excess of chlorine in the daytime, with a sufficiently low concentration at night to permit the normal functioning of the oyster.

In 1930, Dodgson described a system of oyster purification which had been successful in England for 14 years. The oysters are placed on their sides in racks and are treated alternately with three sprayings of water and two 24-hour baths in sea water which is sterilized with 3 p.p.m. of chlorine and then neutralized with sodium thiosulfate. The final spraying is followed by an hour's bath in sea water containing 3 p.p.m. of chlorine. This is done to sterilize the conditioning tanks and the outside of the shells. Following the conditioning, the oysters are stored in sterile bags. It was found that increases in the length of time of conditioning did not appreciably enhance the purity of the shellfish. A standard of not more than five lactose-fermenting bacteria per milliliter of crushed whole oyster and its liquor was adopted.

The oysters used in our study were taken from Narragansett Bay. Upon arrival at the laboratory,[1] they were stored in a live trap until needed. A few days before each experiment, test oysters were brought into the laboratory and placed in glass aquaria through which sea water ran continuously.

The cultures employed were strains of coliform bacteria isolated from polluted oyster-producing areas in the Chesapeake Bay. They were characteristic Escherichia coli and retained their aerogenic properties when exposed to sea water.

The coliform scores were determined by the use of the standard fermentation tests (American Public Health Association, 1943) and Hoskins' (1940) most probable number tables. Plate counts were made with tryptone-glucose-extract agar (Bacto). All incubations were at 37° C. Fermentation tubes were incubated for 48 hours. Plates were counted at the end of a 24-hour incubation period.

The first set of experiments was designed to determine the extent to which coliform bacteria are eliminated by the oyster. The apparatus used was a modification of the one employed for the "drop count" method described by Galtsoff, Prytherch, Smith, and Koehring (1935). It consisted of a mixing chamber through which the sea water ran prior to entering a second chamber which housed the oyster. The volume of the mixing chamber was 1500 milliliters and that of the experimental chamber, 4500 milliliters. The rate of flow from the first to the second was 1020.4 milliliters per minute. The oyster was arranged with a rubber dam so that the water passing through it could be collected.

Before the experiment, samples of water were taken from each chamber for quantitative bacteriological determinations. Immediately following this sampling, a known quantity of coliform bacteria was added to the mixing chamber. Samples of the oyster effluent were collected after 5, 10, 30, 60, 120, and 180 minutes and after 24 hours. At the end of 48 hours, samples of water in the experimental tank and of that passing through the oyster were taken, and the oyster was removed for bacteriological examination. All samples were tested quantitatively for coliform content, and standard plate counts were made. The oyster meat was minced with the shell liquor and a known volume of sterile water, and portions of the mixture were cultured.

In the second set of experiments, eight oysters were placed in an aerated aquarium for 24 hours. At the end of this time, two oysters were removed for quantitative bacteriological tests. Following this, a known quantity of coliform bacteria was added to the aquarium water, and 3 hours thereafter, a second pair of oysters was removed for bacteriological examination. At this time a solution of chloramine-B was added to the water in a concentration which yielded 0.03 p.p.m. of free chlorine. This residual chlorine content was maintained for 48 hours. Thirty minutes after the chlorine had been added, a third pair of oysters was removed for bacteriological determination. After 48 hours' exposure to the chlorinated sea water, the fourth pair was subjected to bacteriological testing.

In the first set of experiments, determinations were made on four oysters. The data are shown in Table 1 (p. 10). They indicate that the majority of coliform bacteria are taken up rapidly by the oyster, since the discharge water contains relatively few of them. In each case there is a marked drop in the coliform content after 30 minutes, and from then on very few or none can be demonstrated in either the discharge water or the oyster. After 48 hours, coliform bacteria were demonstrable in only one of the four oysters, and the effluent from this specimen had

[1] These experiments were carried out at the Marine Biological Laboratory, Woods Hole, Mass.

been free of coliform bacteria after the first 30 minutes. The plate-count data are not included because of the wide fluctuations, which made any interpretation impossible.

Table 1 - Bacterial Content of Oysters Held in Flowing Sea Water and of Their Effluent

Source of Samples	Most Probable Number of Coliform Bacteria per 100 ml.			
	1st Oyster	2nd Oyster	3rd Oyster	4th Oyster
a) Water in mixing chamber at start	7.3	43.0	120.0	39.0
b) Water in experimental chamber at start	7.3	150.0	120.0	23.0
c) Water in mixing chamber immediately after addition of pure culture of E. coli	-	-	59600.0	67300.0
d) Oyster effluent 5 mins. after c)	0	150.0	210.0	75.0
e) " " 10 " " "	0	150.0	1100.0	1100.0
f) " " 30 " " "	9.1	21.0	39.0	1100.0
g) " " 1 hour " "	-	0	9.1	0
h) " " 2 hours " "	-	0	3.6	0
i) " " 3 " " "	-	0	3.6	0
j) " " 24 " " "	-	0	3.6	0
k) " " 48 " " "	-	0	0	0
l) Whole oyster 48 " " "	0	0	0	23.0

The data obtained in the second set of experiments are given in Table 2. The oysters contained coliform bacteria initially, and these were not eliminated during the 24-hour acclimatization period. The effect of the addition of the

Table 2 - Effect of Chlorination on Bacterial Content of Oysters Held in Aerated, Standing Sea Water

Source of Samples	BACTERIAL COUNTS			
	1st Run		2nd Run	
	M.P.N. coliforms per 100 mls.	Plate Count per ml.	M.P.N. coliforms per 100 mls.	Plate Count per ml.
a) Two oysters taken after 24 hours in aquarium, immediately before addition of pure culture of E. coli	1100.00 9.1	245 110	3.6 1100.0	45 38
b) Aquarium water immediately after addition of pure culture of E. coli	3200.0	-	26400.0	-
c) Two oysters taken 3 hours after (b) and immediately before addition of chloramine-B	150.0 -	62 29	20.90 1100.0	73 70
d) Two oysters taken 30 mins. after addition of chloramine-B	7.3 -	40 34	1100.0 1100.0	37 34
e) Two oysters taken 48 hours after addition of chloramine-B	0 -	175 70	23.0 9.1	126 145

culture is not clear, since the oysters themselves varied considerably in their initial bacterial content. The addition of the chlorine solution and the maintenance of 0.03 p.p.m. of free chlorine for 48 hours yielded coliform-free oysters in one instance but not in the other. The plate counts showed an actual increase under these conditions in both instances.

The results of these meagre experiments lead to two probable conclusions regarding oyster conditioning. The first is that oysters having access to a continuous supply of running water are capable of freeing themselves of demonstrable coliform bacteria within a very short period, possibly within 30 minutes. Second, storage in a tank at a concentration of chlorine which permits the normal functioning of the oyster (Galtsoff, 1946) over a period of 48 hours does not result in coliform-free specimens, nor does it lower the total bacterial content of the oyster. Therefore, conditioning by the described method of chlorination is probably

inadequate for the production of coliform-free oysters. These results also confirm the work of previous investigators.

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"S. S. PACIFIC EXPLORER"--A PRELIMINARY DESCRIPTION

By Carl B. Carlson*

The recently completed factory ship, the Pacific Explorer, left in January for Central and South American waters to engage in the tuna fishery. It is expected that the vessel will act as a mother ship for a fleet of twelve or more fishing vessels, supplying their operating materials and preserving their catch. Thus, fuel and other supplies produced in the United States will be provided on distant fishing grounds, and the range and productivity of our fishing fleets can be greatly extended. The ship has sufficient capacity to freeze and transport 3,800 tons of tuna. During the period of summer in northern waters, the vessel will operate in the Bering Sea, canning or freezing king crabs and preparing frozen fillets from bottom fish.

BACKGROUND FOR THE PROJECT: American fishing activities have, in general, been confined to relatively nearby areas within a practical cruising range of our fishing fleets. Except in the tuna fishery, reliance on ice for preservation of the catch has also tended to restrict the range of our fishing vessels. As our population grows, it can be expected that protein foods from the sea will become increasingly important to our national welfare. Our fishing vessels may then have to travel to more distant areas.

Before World War II, the Japanese Government operated a fleet of exploratory vessels, reported to be up to 50 in number,[1/] whose activities ranged from Bering Strait through the north, west, central, and southern portions of the Pacific Ocean and into the Antarctic regions. The information obtained from these explorations led to an ocean-wide expansion of fishing effort until the annual, prewar, Japanese catch reached an average of 10 to 12 billion pounds from the Pacific alone, as compared with a United States catch of about 4.5 billion pounds from both the Atlantic and Pacific Oceans. A substantial portion of the Japanese catch consisted of premium items, such as tuna and king crabs, which were shipped into the United States and sold in competition with our own products.

DEVELOPMENT OF FACTORY SHIPS: The development of factory ships afforded the Japanese a method of expansion throughout the Pacific.

In 1892, crab canning was started by the Japanese on stocks taken from local waters. The industry grew slowly until 1923, when, as a result of several years of successful government investigation, factory ships were introduced. These provided a sound technical basis for expansion of the industry from the waters of Japan proper to Kamchatka and Siberian waters, and in 1930, to our side of the Bering Sea, and finally into Bristol Bay, which is the principal Alaskan center for canning red salmon. Prior to World War II, there was strong evidence that the Japanese were conducting experimental work which could have led to harmful exploitation of the salmon fisheries off Alaska. As a result of discussions between the United States and Japanese Governments, the Japanese gave assurances that measures would be taken to prevent such operations. Farther south, the Japanese extended their activities to Mexico through concessions granted by the Mexican Government. The Japanese tuna fishery expanded eastward from the home islands

* Fishery Engineer, Fishery Technological Laboratory, Seattle, Washington.

1/ Chapman, W. L., 1946, "Tuna in the Mandated Islands." Far Eastern Survey, 15 (20): 317-319.

to Wake Island and southward through Formosa, the Philippine Islands, North Borneo, and the Mandated Islands to Australia. Whalers were sent to the Argentine coast.

"Increasing exploitation of a crab fishery by foreign nationals in water immediately adjacent to United States' territory, for subsequent export into the United States, raised serious questions as to whether American interests were making adequate use of domestic fishery resources. Accordingly, early in 1940, the President requested the Secretary of the Interior to investigate the practicability of establishing an American king crab canning industry in Alaska. Initial inquiry indicated that lack of information regarding areas of abundance, methods for taking and canning king crabs, and a general fear of not being able to compete with the imported product on a cost basis, were the primary obstacles retarding domestic development. Since the cost of necessary exploratory work would be prohibitive for private enterprise under conditions then prevailing, Congress authorized the Fish and Wildlife Service to make the study."2/

The results of this work disclosed the presence of tremendous quantities of not only king crabs but also of edible bottom fish. In 1945, when the War Food Administration was searching for additional sources of protein food, the wartime Office of the Coordinator of Fisheries of the Department of the Interior recommended that these Alaskan bottom fish be utilized. The War Food Administration recommended that the Defense Plants Corporation (a subsidiary of the Reconstruction Finance Corporation), in the interest of national defense, acquire an ocean-going vessel, convert it to a factory ship, and construct five fishing vessels to accompany the factory ship and supply it with raw materials.

After the cessation of hostilities with Japan, the War Food Administration was unable to reaffirm its recommendation of the essentiality of the project strictly as an emergency food measure but, realizing the postwar potentialities, recommended that the project be referred to other interested agencies. The Director of War Mobilization and Reconversion--basing his actions on recommendations of the Department of the Interior, the State Department, and the Navy Department and on the fact that the conversion was well advanced--determined that it would benefit the Government and the fishing industry to complete the conversion and to construct four fishing vessels. To assure that the Government and the domestic fishing industry would obtain a maximum amount of useful economic, scientific, and other information from the operation of the vessels, provision was made for representatives of the Government to accompany the vessels and publish reports on their observations.

The Pacific Exploration Company was designated as the agent for the Reconstruction Finance Corporation in the construction and operation of the fleet of vessels. W. C. Nickum and Sons and H. C. Hanson were accepted as naval architects for the mother ship and the fishing vessels, respectively. Since much of the information required in designing a fleet of vessels for the varied purposes planned was not common knowledge among marine architects, the Fish and Wildlife Service delegated a fishery engineer to assist, on a part-time basis, in making available the facilities, knowledge, and experience of the Service.

The ship was so designed that it could act as an independent cargo carrier or serve as a mother ship for a fleet of fishing vessels in any part of the Pacific Ocean or adjoining waters. The fishing vessels were designed to operate as independent units in the tuna, otter-trawl, purse-seine, line-trawl, or bottom gillnet fisheries or to accompany a mother ship to any location in the Pacific.

2/"The Alaskan King Crab," published in Fishery Market News, May 1942 - Supplement, pp. 3-4.

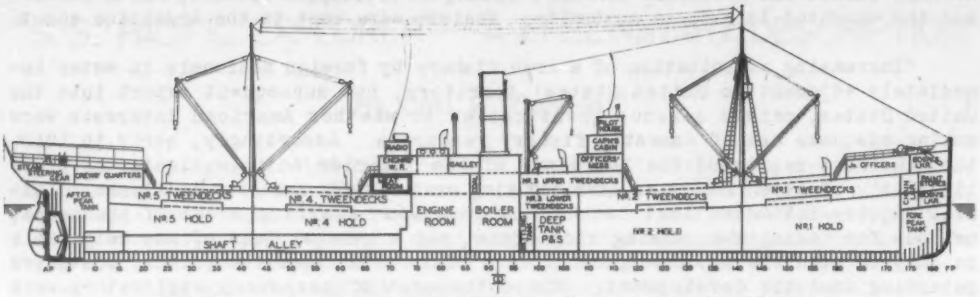


FIGURE 1 - S.S. PACIFIC EXPLORER (EX-MORMACREY) BEFORE CONVERSION

The mother ship and the fleet of fishing vessels are leased to the Pacific Exploration Company for a period of 7 years at a rental of $50,000 per year, or 55 percent of the profits, whichever is the greater. The Pacific Exploration Company is to pay all maintenance and operating costs.

DESCRIPTION OF THE "PACIFIC EXPLORER": The Pacific Explorer (ex-Mormacrey) was one of the 8,800-ton class of vessels built during World War I and had the following registry data:

OFFICIAL NUMBER	- 218,294	LENGTH	- 410.0 FT.
GROSS TONNAGE	- 5,946	BEAM	- 54.4 "
NET TONNAGE	- 3,744	DEPTH	- 27.2 "
HORSEPOWER	- 3,500	CREW	- 31

The vessel was of the 3-island type (see Figure 1), having a raised forecastle, a raised bridge deck structure amidships, and a raised poop. The propulsion engine was a triple-expansion type. For reasons of economy, it was decided that no changes would be made in the engine or boiler rooms.

PROBLEMS OF RECONVERSION: Several general over-all plans were considered in the reconversion to determine the optimum allotment of space and to provide the most efficient flow of materials through the ship. Some of the main factors which had to be considered were:

1. The first vessel of a given type is always experimental, and flexibility had to be provided to allow for alterations after a period of operation.
2. The vessel would be required to work with different products on the northern and southern trips.
3. Space on a ship is drastically limited, yet the flow of materials on this vessel had to be arranged for versatility and simplicity.
4. Mechanization had to be introduced wherever possible to reduce the manpower requirements.
5. A large amount of sheltered working space would be required for the northern voyages to provide for filleting, freezing, and canning operations.
6. It was necessary to provide maximum cubic capacity and abundant frozen storage space, particularly for the southern trips. Provision had to be made to freeze 130 tons of fish per day, based on fish and condenser water temperatures of 85° F.
7. Equipment to can 600 cases of crabs and to prepare 50,000 pounds of fillets in an 8- to 10-hour day had to be incorporated.

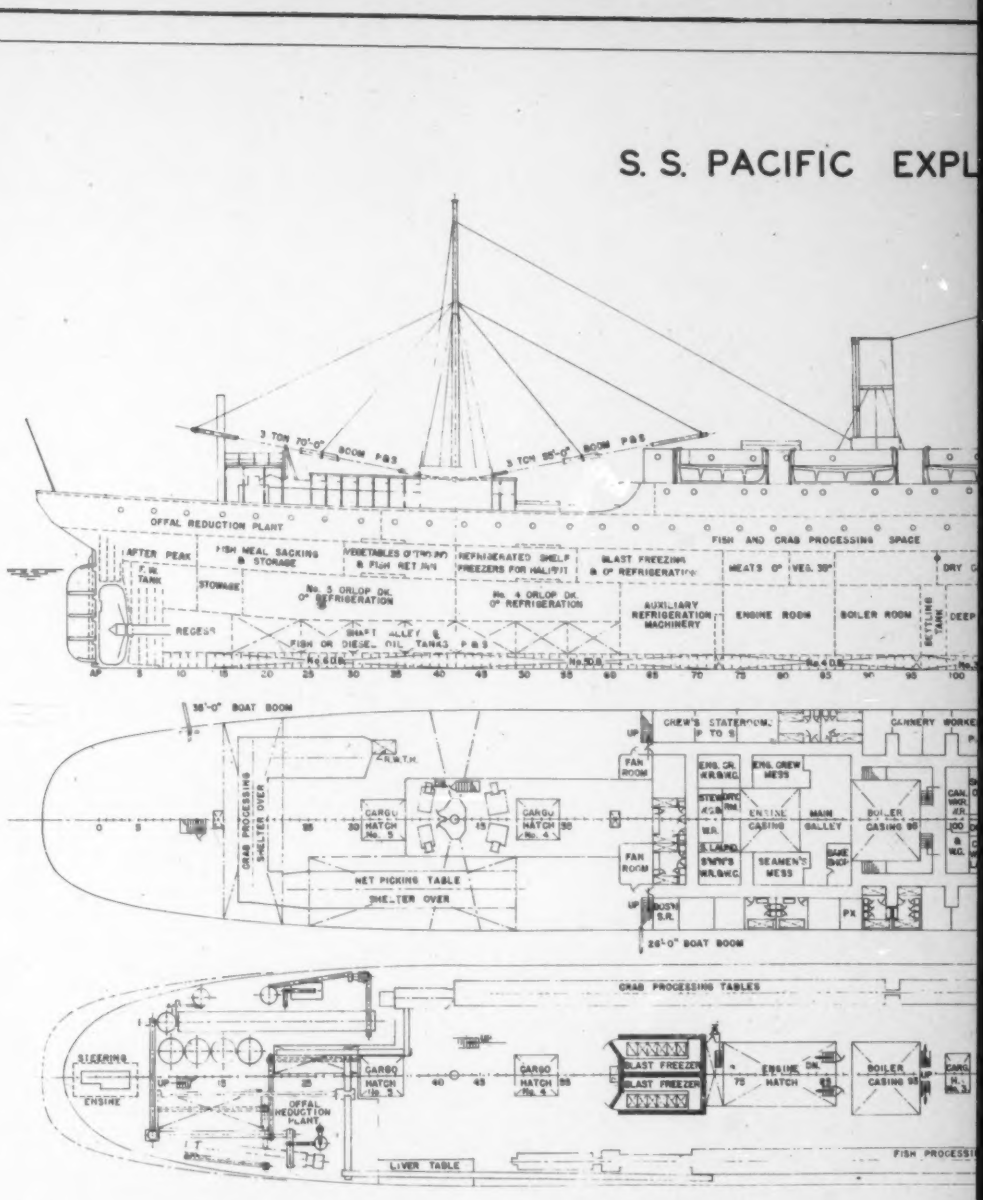
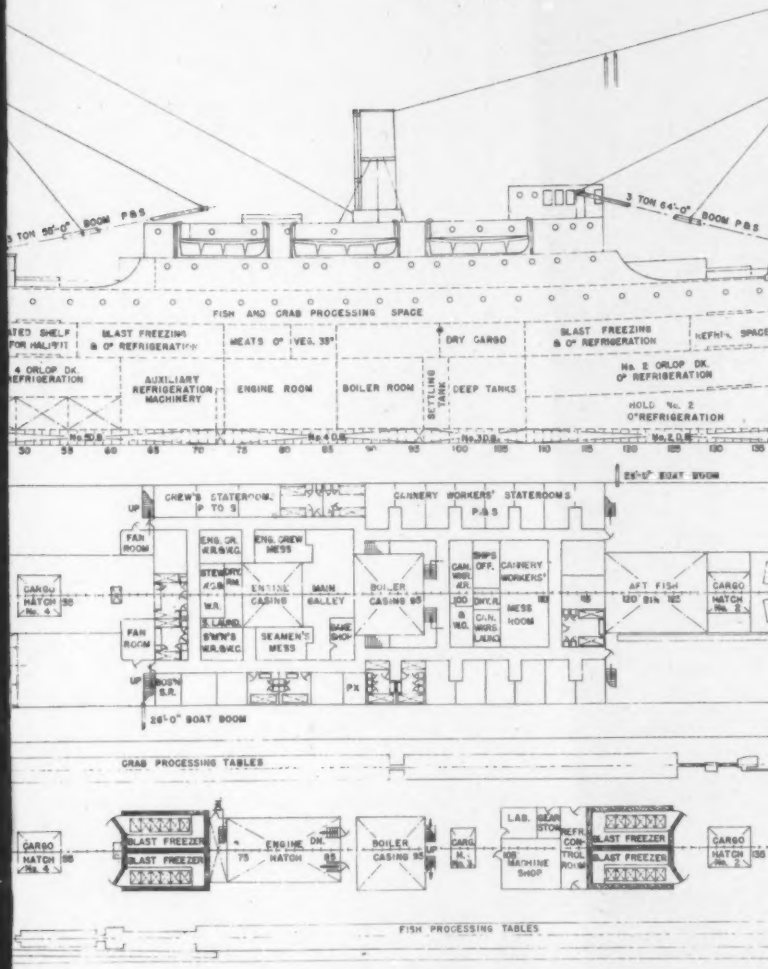
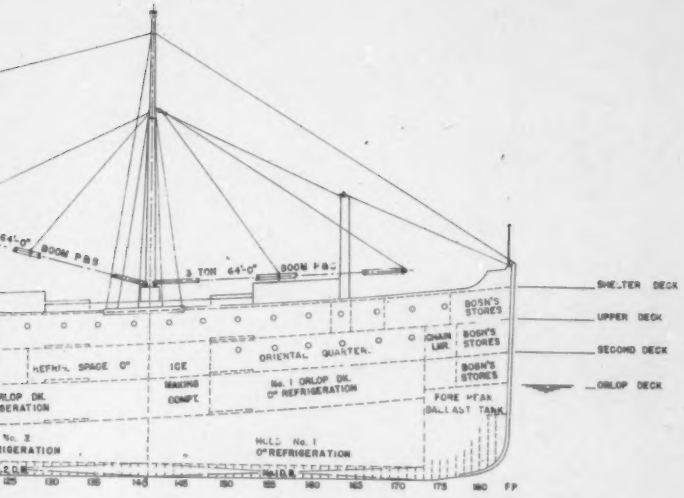


FIGURE 2 - OUTBOARD PROFILE AND UPPER DECKS OF S.S. PACIFIC

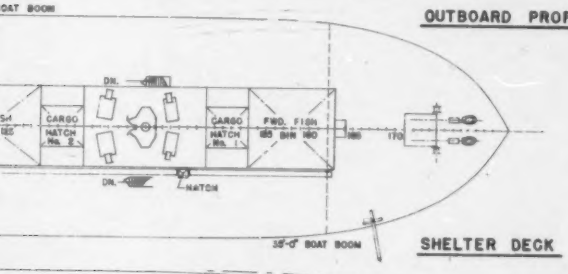
S. S. PACIFIC EXPLORER



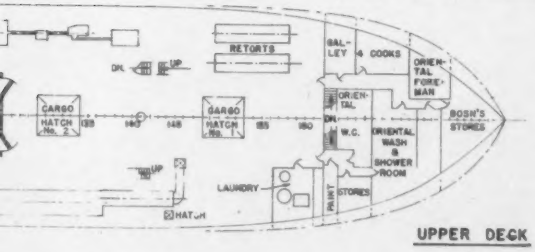
D PROFILE AND UPPER DECKS OF S.S. PACIFIC EXPLORER
--COURTESY W.C NICK



OUTBOARD PROFILE

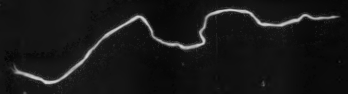


SHELTER DECK



UPPER DECK

J.C NICKUM AND SONS



S. S. PACIFIC EX

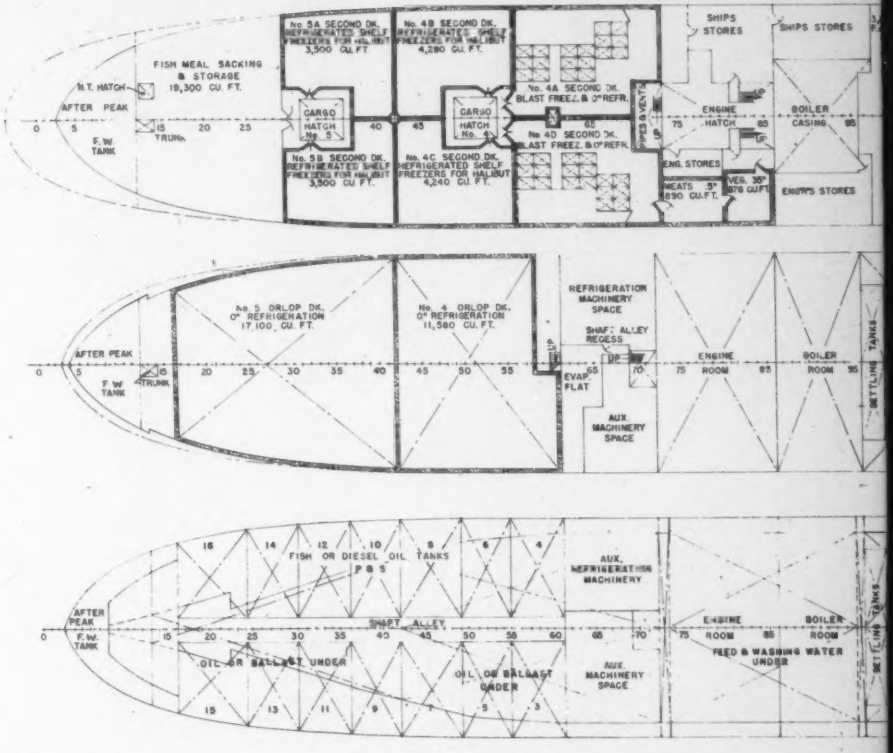
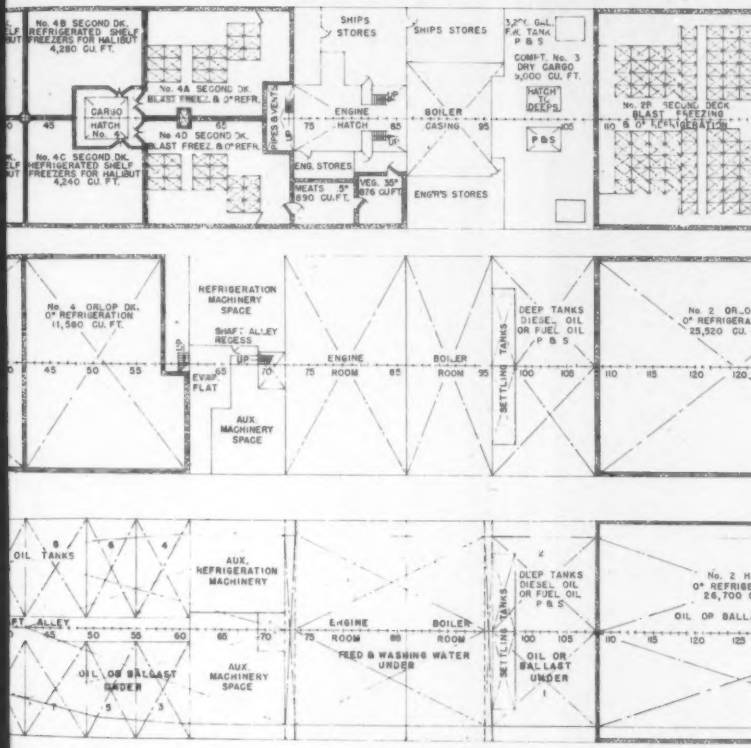

No. 5A SECOND DK. REFRIGERATED SHELF FREEZERS FOR HALIBUT 3,500 CU. FT.
No. 4B SECOND DK. REFRIGERATED SHELF FREEZERS FOR HALIBUT 4,280 CU. FT.
SHIPS STORES
SHIPS STORES
FISH MEAL SACKING & STORAGE 19,300 CU. FT.
M.T. HATCH
AFTER PEAK
CARGO HATCH No. 5
CARGO HATCH No. 4
No. 4A SECOND DK. BLAST FREEZ. & 0° REFR.
No. 4D SECOND DK. BLAST FREEZ. & 0° REFR.
PIPES & VENTS
ENGINE HATCH
BOILER CASING
F.W. TANK
TRUNK
No. 5B SECOND DK. REFRIGERATED SHELF FREEZERS FOR HALIBUT 3,500 CU. FT.
No. 4C SECOND DK. REFRIGERATED SHELF FREEZERS FOR HALIBUT 4,240 CU. FT.
ENG. STORES
MEATS 5° 890 CU.FT.
VEG. 35° 875 CU.FT.
ENGR'S STORES
No. 5 ORLOP DK. 0° REFRIGERATION 17,100 CU. FT.
No. 4 ORLOP DK. 0° REFRIGERATION 11,580 CU. FT.
REFRIGERATION MACHINERY SPACE
SHAFT ALLEY RECESS
AFTER PEAK
F.W. TANK
TRUNK
EVAP. FLAT
AUX. MACHINERY SPACE
ENGINE ROOM
BOILER ROOM
SETTLING TANKS
FISH OR DIESEL OIL TANKS P & S
AUX. REFRIGERATION MACHINERY
AFTER PEAK
F.W. TANK
SHAFT ALLEY
OIL OR BALLAST UNDER
OIL OR BALLAST UNDER
AUX. MACHINERY SPACE
ENGINE ROOM
BOILER ROOM
FEED & WASHING WATER UNDER
SETTLING TANKS

FIGURE 3 - LOWER DECKS OF S.S. PACIFIC EXPLORE

S. S. PACIFIC EXPLORER



GURE 3 - LOWER DECKS OF S.S. PACIFIC EXPLORER
--COURTESY W.C. NICKUM

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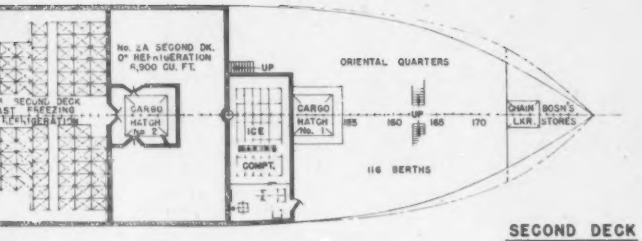
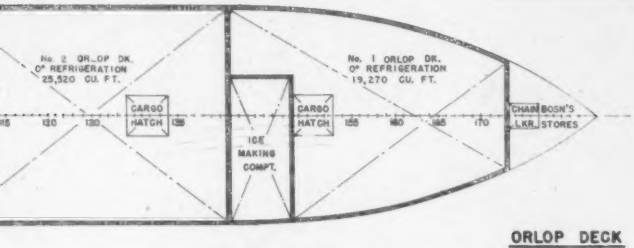
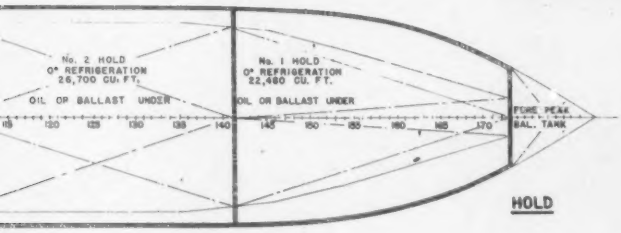


SECOND DECK



ORLOP DECK



HOLD

C. NICKUM AND SONS

8. Machinery and equipment spaces had to be reduced to a minimum, yet many services such as fresh and salt water, steam, electricity, compressed air, vacuum, and refrigeration had to be supplied to various stations throughout the ship. All these installations had to meet the rigid marine-inspection requirements established for the safety of the ship and its personnel.

9. Approximately 240 persons had to be transported, housed, and fed in quarters suitable for voyages of 4 months' duration.

10. Adequate ventilation, an inter-communication system, and a fishing fleet control system had to be installed.

11. It was necessary to provide facilities for all the services of a mother ship to care properly for the accompanying fleet of fishing vessels and their personnel.

STRUCTURAL CHANGES: The final arrangement decided upon is shown in Figures 2 and 3. A new deck house was constructed to accommodate a ship's crew of 50 persons, including a doctor, administrative and scientific personnel of 7, and 60 occidental fish handlers. Quarters were built in the forecastle to house 124 oriental workers.

The wells forward and aft of amidships were covered to transform the vessel to a shelter-deck type. By removal of the interfering structure under the raised deck amidships, the whole former upper deck, with the exception of the boiler and engine casings, was made available for cannery and fish-handling purposes.

The full 18-foot deck height of the original holds would make cargo stowage difficult. Owing to the conditions of operation, only relatively small quantities of cargo would be stowed in the holds at one time, and much of the cargo might be adversely affected by excessively high stacking. Consequently, an orlop deck was added forward and aft as shown. The new orlop deck aft was welded to the shaft-alley covering to provide storage tanks for nearly 500,000 gallons of diesel oil to fuel the fishing fleet and for the diesel electric generators. These tanks can be cleaned, after they are emptied, and used for fish oil storage on the return trip.

Various bulkheads were added to the hull to provide compartments for working, freezing, and storage spaces. A structural bulkhead placed aft of the engine room provided spaces for the diesel electric and ammonia compressor machinery. As safety measures, both of these compartments were made gas-tight and escapes were installed. The various cold compartments were made with non-structural steel sheathing, and the spaces were insulated with a minimum thickness of 9 inches of fiber glass. The freezer spaces were protected by cork board insulation with a minimum thickness of 8 inches.

FISH AND CRAB PROCESSING: Two sets of outrigger booms, one forward on the starboard side and the other aft on the port side, were installed to provide mooring for the fishing vessels. Counterweight towers, with the weight connected directly to one of the mooring lines at each station, were constructed to compensate for the surge of the fishing vessels in a seaway when they are alongside. In the northern operation, it is planned to transfer the fish to the forward storage bins and take the crabs and tangle nets to the after deck by using the ship's gear. During the southern operations, the fish may be loaded both forward and aft but will be held temporarily on the upper rather than the shelter deck to protect them from the tropical sun.

The bottom fish will be conveyed from the bins to a rotary washer and then to the filleting table, which has provision for 70 workers. Conveyor belts are to conduct the waste products to the liver-picking table and then to the reduction plant, which has a capacity of 5 tons per hour and requires four operators. The cut fillets are to be transferred in pans to an inspection table and then to a continuous brine-dip tank. After being brined, the fillets will be weighed, packaged, transferred to racks, and then trucked to the upper-deck blast freezers. The fillet plant is designed to accommodate in excess of 85 workers.

It is planned to stow the tangle nets and king crabs on pallets and transfer the nets containing crabs to a net-picking table. After removal from the nets, the crabs will be conveyed to a butcher-and-trim table and then to a continuous cooker. After being cooked, the crabs will fall into a cooling tank on the upper deck, and the leg segments will be separated; next, the segments will be transferred to a shaking table and the meat washed and exposed to acid and brine dips. Subsequently, the pans of meat will be conveyed to a packing table and the filled cans conducted to the sealing machinery and the retorts. Provision is made on the crab-canning line to accommodate 127 workers.

REFRIGERATION: It is believed that the ammonia compressor plant of the Pacific Explorer has larger capacity than any other ever installed on a United States vessel. While there are refrigerated ships having a cubic capacity far in excess of the Pacific Explorer, they are designed for transporting meat and fruit, and few, if any, are expected to hold cargo at less than 15° F. It is estimated that the cargo space on the Pacific Explorer can be held at 0° F. or lower and that 130 tons or more of fish per day can be frozen at the same time. To insure continuity of operations and safety of the cargo in the event of a partial breakdown of the compressor plant, a suitable safety factor has been allowed.

It was decided to use a flooded system supplied by a two-stage compressor plant because of the large amounts of ammonia required to do the job and the very low temperatures desired in the freezers. Had a single-stage compression system been used, the piping requirements would have been far greater to transport the large volume of gases involved. The two booster compressors are driven by motors of 125 and 50 horsepower, respectively, and have respective capacities of 134 and 65 tons of refrigeration at a suction temperature of -25° F. and a discharge pressure of 24 pounds per square inch. Two of the high-stage machines are each driven by 175 horsepower motors and have a combined capacity of 230 tons of refrigeration, while a third high-stage compressor is driven by a 45-horsepower motor and has a capacity of 21 tons, all at a suction pressure of 24 pounds and a discharge pressure of 190 pounds.

The booster compressors draw gaseous ammonia from surge drums at various locations about the ship, and the partially compressed gas is discharged into a direct-expansion liquid and gas cooler. The gas is then further compressed by the high-stage machines and cooled to become high-temperature liquid ammonia. A portion of the high-temperature liquid is used in making ice and in cooling water for the ventilation system. The ice plant has a capacity of 15 tons per day. The remaining high-temperature liquid is cooled by being passed through coils in the direct-expansion liquid and gas cooler to become subcooled liquid for use in the storage and freezer spaces. Hot gas from the high-stage side may be used to defrost the various storage-room coils.

The subcooled liquid is pumped to surge-drum reservoirs from which the liquid ammonia is circulated through the various freezing coils throughout the ship. The

ammonia absorbs heat in these coils, evaporates, and is then drawn back to the surge drums and thence to the suction side of the boosters.

Each of the four upper-deck blast freezers will take a charge of 6,000 pounds of packaged fillets on a system of racks and trays. These fillets are expected to be frozen in less than 6 hours. By the removal of a portion of the trays, small tuna can be frozen on the same racks. In the large blast freezers on the second deck, the larger tuna will be placed on individual trays which are supported by an iron framework. Several portable conveyors of vertical and variable-angle types are to be used to transfer materials between various levels.

The power for the compressor plant, fish house, and ship service is supplied by 3 AC diesel-electric plants, each developing 300 kilowatts and having a prime mover of 450 horsepower. Here again the capacity is in excess of the actual requirements to insure the continuity of operations and the safety of the cargo in the event of partial breakdown.

Observers and technical personnel from the Fish and Wildlife Service who are accompanying the expedition will present a more detailed report of the ship and its operations at a later date.

TUNA FISHING

The area fished by the southern California tuna fleet reaches from the coast of southern California to and slightly beyond the equator, extending from the continental mainland to points approximately 800 miles off shore and includes areas around practically all the islands within these general limits, including the Revilla Gigado Islands, Clipperton Island, Cocos Island, and the Galapagos Islands.

The large "bait fishing" vessels forming the high-seas tuna fleet, which fish for skipjack and yellowfin, bring in from 60 to 70 percent of the total catch and work the fishing grounds as follows: In the winter months, or from November to the end of February, the fleet is found off the Galapagos Islands. The boats then fish off the mainland coast of Central America through March, April, and May. In June and July, they may fish in the Gulf of California or around Cape San Lucas. In August and September, the fleet covers the lower California coastal area with the neighboring banks and islands as far as Clipperton Island. In the fall months, they mostly return to the mainland coast of Central America. While this is the general procedure, the judgment and experience of the individual captain as to fishing conditions in the various known areas and advance information on the availability of bait, or presence of fish, are the principal factors governing exploitation of the fishing grounds.

--Fishery Leaflet No. 82

RECEIPTS OF FISHERY PRODUCTS AT CHICAGO, 1945

By C. M. Reardon*

The receipts of fresh and frozen fishery products in the Chicago Wholesale Market during 1945 totaled 77,669,000 pounds. This figure exceeded the 1944 total of 66,000,000 pounds by 17 percent. The total for 1945 was, however, 8 percent less than the 1943 total of 84,034,000 pounds.

CHICAGO MARKET - TYPICAL SIDEWALK SCENE

Of the total volume received during 1945 (Table 1), fresh-water species accounted for 50 percent; salt-water species, 38 percent; and shellfish and miscellaneous items, 12 percent. Fresh-water receipts gained approximately 2 percent over those of 1944, and salt-water fish and shellfish rose 46 and 13 percent, respectively, during the same period.

The number of items received, divided into the classifications fresh, frozen, filleted, etc., totaled 192. These items originated in 48 different areas, including 38 States, 9 Canadian provinces, and Alaska.

Table 1 - Receipts by Types of Fish - 1945 and 1944

Item	Fresh-water fish		Salt-water fish		Shellfish, etc.		Total	
	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
1945	38,763,386	50	29,783,227	38	9,121,919	12	77,668,532	100
1944	38,132,598	57	20,438,854	31	8,089,016	12	66,660,468	100
Change from 1944	+ 630,788	+2	+9,344,373	+46	+1,032,903	+13	+11,008,064	+17

Of the States (Table 2) which contributed the greatest amount to the total receipts, Wisconsin led with 11 percent, followed by Massachusetts and Michigan with 10 percent each. Washington, with 5 percent, advanced from ninth place in 1944 to fifth place in 1945. Minnesota likewise contributed 5 percent of the total volume. Trailing these States were Ohio with 4 percent; Iowa, Louisiana, and Illinois with 3 percent each, and New York and Mississippi with 2 percent, respectively.

Alaska, credited in Table 2 with direct shipments only, would have been in third place with 10 percent if credit had been given for the 6,048,000 pounds caught in United States waters by American fishermen and shipped in bond through Canada to the United States. This amount, however, was credited to British Columbia.

British Columbia led all States and other Canadian provinces with 14 percent of the total receipts. Only 6 percent of the total receipts, however, were Canadian produced fish. Manitoba was second among Canadian provinces with 8 percent, followed by Nova Scotia with 3 percent.

In 1944, Manitoba led all States and provinces in total pounds delivered (all fresh-water fish).

*In Charge, Fishery Market News Service Office, Chicago, Illinois.

Table 2 - Receipts from Major Shipping Sources - 1945

State or Province	1945 volume	Percentage of 1945 receipts						Change from 1944		
	Lbs.	Fresh-water	Salt-water	Shellfish	Domestic	Imported	Total	Lbs.	%	Principal reason
Wisconsin	8,588,526	22	-	*	16	-	11	+1,030,858	+ 14	+Lake herring, sheepshead
Michigan	7,517,715	19	-	*	14	-	10	+ 284,529	+ 4	+Lake herring, suckers
Massachusetts	7,384,190	*	18	2	14	-	10	+2,085,378	+ 39	+Cod, haddock, rosefish
Minnesota	4,210,101	11	-	-	8	-	5	+ 824,980	+ 24	+Bullheads, yellow pike
Washington	4,088,871	-	14	*	8	-	5	+2,301,840	+129	+Lingcod, sablefish, salmon
Ohio	2,946,177	8	-	-	6	-	4	+ 139,946	+ 5	+Sheepshead, yellow perch
Iowa	2,573,552	7	-	-	5	-	3	+ 469,142	+ 22	+Carp, sheepshead, buffalo
Louisiana	2,418,525	*	*	27	5	-	3	-1,315,877	- 65	-Shrimp
Illinois	1,997,622	5	-	-	4	-	3	+ 217,129	+ 12	+Carp, buffalofish
Mississippi	1,675,150	-	-	18	3	-	2	+1,183,255	+240	+Shrimp
New York	1,496,101	*	1	13	3	-	2	+ 493,785	+ 49	+Oysters
Alaska	1,468,097	-	5	-	3	-	2	-2,277,571	-291	-Halibut, see British Columbia
British Columbia**	10,869,833	-	36	-	11	20	14	+4,801,136	+ 79	+Halibut, see Alaska
Manitoba	6,321,772	16	-	-	-	26	8	-1,585,215	- 20	-Lake trout, sauger
Nova Scotia	2,067,570	-	7	-	-	8	3	- 96,204	- 4	-Cod, haddock

*Less than of one percent.
**Includes catch taken by U. S. vessels and shipped through Canada to the U. S. in bond.

Receipts by motor truck during 1945 (Table 3) continued the decline which started in 1944 and were 30 percent below the 1944 figure, which in turn was 22 percent below the 1943 figure.

These declines were largely due to the scarcity of tires, restricted gasoline supplies, and the general lowering of the efficiency of the operating equipment. On the other hand, fish receipts by railway express rose 33 percent and by rail freight, 26 percent over 1944.

Railway express moved 36,800,000 pounds, or 47 percent of the total during 1945, while rail freight handled 30,637,000 pounds, or 40 percent. Truck receipts amounted to 10,231,000 pounds, or 13 percent. In 1944, railway express handled 41 percent; rail freight, 37 percent; and motor truck, 22 percent of the total receipts. The bulk of fishery products of domestic origin was handled by railway express, while the greater portion of the imported varieties was moved by rail freight (Table 4).

During the latter part of the year, several small shipments of highly perishable commodities such as oysters, shrimp, and lobsters were received by air express.

Considerable additional gear entered Great Lakes waters during the last few months of 1945 due to the return of veterans who were formerly part of the fishing crews. Much of this gear was badly in need of repair due to lack of replacement equipment. New gear was very scarce.

During 1945, the four species leading in the Chicago receipts, by volume (fresh and frozen items combined), were halibut, 8,676,000 pounds; lake trout, 6,764,000 pounds; shrimp, 5,605,000 pounds; and whitefish, 5,201,000 pounds. These were followed by salmon, carp, lake herring, cod, and suckers, each with a total of over 3,000,000 pounds.

Table 3 - Receipts by Methods of Transportation - 1945 and 1944

Item	Truck		Express		Freight		Total	
Classifications:	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
All, 1945	10,231,433	13	36,799,898	47	30,637,201	40	77,668,532	100
1944	14,664,285	22	27,650,522	41	24,345,661	37	66,660,468	100
Change from 1944	-4,432,852	-30	+9,149,376	+33	+6,291,540	+26	+11,008,064	+17
Fresh-water, 1945	7,328,268	19	26,257,414	68	5,177,704	13	38,763,386	50
1944	10,037,039	27	21,536,072	56	6,559,487	17	38,132,598	57
Change from 1944	-2,708,771	-27	+4,721,342	+22	-1,381,783	-21	+ 630,778	+2
Salt-water, 1945	1,571,144	5	7,453,867	25	20,758,216	70	29,783,227	38
1944	2,082,027	10	4,585,424	23	13,771,403	67	20,438,854	31
Change from 1944	- 510,883	-25	+2,868,443	+63	+6,986,813	+51	+9,344,373	+46
Shellfish, etc., 1945	1,332,021	15	3,088,617	34	4,701,281	51	9,121,919	12
1944	2,545,219	31	1,529,026	19	4,014,771	50	8,089,016	12
Change from 1944	-1,213,198	-48	+1,559,591	+102	+ 686,510	+17	+1,032,903	+13
Origin:								
Domestic, 1945	9,915,878	19	28,655,471	54	14,725,589	27	53,296,938	69
1944	13,826,172	30	19,411,997	42	12,709,875	28	45,948,044	69
Change from 1944	-3,910,294	-28	+9,243,474	+48	+2,015,714	+16	+7,348,894	+16
Imported,* 1945	315,555	1	8,144,427	34	15,911,612	65	24,371,594	31
1944	838,113	4	8,238,525	40	11,635,786	56	20,712,424	31
Change from 1944	- 522,558	-62	- 94,098	-1	+4,275,826	+37	+3,659,170	+18

*Includes catch taken by United States vessels and shipped through Canada to the United States in bond.

A comparison of the fluctuations of some of the important items reveals that receipts of blue pike fell below those for 1944, as well as those for the two years previous; halibut showed a gain of 9 percent over 1944; lake trout declined 7 percent; shrimp and whitefish declined 3 percent and 12 percent, respectively; while

Table 4 - Receipts by Methods of Transportation - 1945

Item	Truck		Express		Freight		Total	
Classifications:	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
All	10,231,433	100	36,799,898	100	30,637,201	100	77,668,532	100
Fresh-water	7,328,268	72	26,257,414	72	5,177,704	17	38,763,386	50
Salt-water	1,571,144	15	7,453,867	20	20,758,216	68	29,783,227	38
Shellfish, etc.	1,332,021	13	3,088,617	8	4,701,281	15	9,121,919	12
Origin:								
Domestic	9,915,878	97	28,655,471	78	14,725,589	48	53,296,938	69
Imported*	315,555	3	8,144,427	22	15,911,612	52	24,371,594	31

*Includes catch taken by United States vessels and shipped through Canada to the United States in bond.

carp, catfish, buffalofish, lake herring, pickerel, sheepshead, among the fresh-water varieties, and cod, haddock, and whiting, among the salt-water varieties, made important gains (Table 5).

Of the important salt-water varieties from the east coast, cod (all items) gained 46 percent in volume over 1944; haddock (all items) showed a 76 percent increase; hake (all items) advanced 380 percent; mackerel (all items) gained 265 percent. Pollock showed a gain of only 7 percent, but whiting (all items) increased 143 percent. Rosefish, mostly frozen fillets, showed a decline of 26 percent during 1945.

Many west coast seafood items attained greater importance on the local market during 1945 than in any previous year. This was particularly true of rockfish, chiefly fresh and frozen fillets; lingcod, mostly frozen; and frozen sole fillets. Shad and shad roe from the west coast, although not received in large volume, attained fair importance locally. Receipts of shark meat and shark fillets almost ceased toward the latter part of 1945.

Table 5 - Receipts by Important Species - 1945

Species	Percentage change from 1944	
	Fresh	Frozen
Blue pike	- 56	-
Buffalofish	+ 58	-
Bullheads	+ 11	-
Carp	+ 55	-100
Catfish	+ 93	-100
Chubs	+ 40	-100
Lake herring	+ 13	- 78*
Lake trout	- 11	+ 12*
Pickerel	+ 40*	- 10*
Sauger	- 25*	- 95*
Sheepshead	+ 44	- 27*
Smelt	+476	-100
Suckers	+ 36*	+ 52*
Tullibee	- 5	+ 76
Whitefish	- 8	- 16*
Yellow perch	- 6*	- 63
Yellow pike	- 16*	- 29*

Species	Percentage change from 1944	
	Fresh	Frozen
Cod	+145*	+ 33*
Flounder and sole	- 7*	+267*
Haddock	+517*	- 28*
Halibut	+ 11	+ 8
Mackerel	+176*	+ 94*
Pollock	+1700*	- 24*
Rockfish	+100*	+409*
Rosefish fillets	- 71	- 25
Sablefish	- 49	+ 48*
Salmon	+ 70	+ 92
Whiting	+1766*	+134*
Clams	+ 12	-
Lobsters	+119	+100
Oysters:		
Shell	+ 86	-
Shucked	+ 49	-
Shrimp	-230	+ 69**
Spiny lobster tails	+ 7	- 95

*Includes fillets

**Includes breaded and peeled shrimp.

Among shellfish items, shrimp was by far the most important, accounting for 61 percent of the total shellfish receipts. Lobster receipts more than double those for 1944, and receipts of shell and shucked oysters totaled twice the 1944 production. Spiny lobster tails, chiefly from Florida, declined 40 percent below the 1944 receipts.

As in 1944, March was the month of greatest receipts of fresh-water varieties. This was made possible by consistently large receipts of lake trout, whitefish, smelt, and yellow pike. There were also better than average receipts of the above varieties in frozen form.

Salt-water receipts reached their highest point during June. Unusually large receipts of fresh and frozen halibut during that month accounted for 43 percent of all salt-water items. Salt-water receipts remained high from May until November. In 1944, December was the most productive month for salt-water items due to large receipts of frozen halibut and silver and fall salmon.

Shellfish receipts reached their highest total during the month of October. Shrimp, however, which was the leading shellfish item, was received in greatest quantity in the fresh state during August. Frozen shrimp receipts reached their peak during September.

Total receipts of all fresh and frozen fish and shellfish reached their highest figure in June 1945, whereas receipts during 1944 reached their highest point in March. In 1943, May was the month of greatest production.

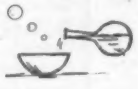
TECHNOLOGICAL RESEARCH IN SERVICE LABORATORIES

NOVEMBER 1946

Mayaguez, P. R.

Fishermen of Puerto Real were assisted in planning the organization and financing of a production cooperative.

No cases of fish poisoning were reported during the month, and all the feeding tests were negative. Bacteria grown on fish samples held at room temperature appeared to produce a heat-labile, filterable toxin which produces illness or death when injected intraperitoneally into mice.



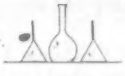
Boston, Mass.

An experimental pack of a new commercial fishery product was bacteriologically tested for sufficiency of process, and suggestions were made as to suitable packages and working methods.

At Eastport, Maine, further tests were run on the electrical smoking of sardines and also on the baking of the fish in the open cans. As a result of these tests, a smoke dehumidifier and a longer smoke-precipitation chamber will be tried.

A fillet packer, having trouble with a malodorous yellow slime that developed on the parchment wrapping of his product, was shown that some of the excess wrappers set out for his workers came in contact with moisture from the fillets and were then returned to stock to be used on succeeding days. When these wrappers were used later, they gave rise to the slime growth. It was suggested that any soiled excess wrappers be destroyed at the end of each day's operations.

A series of samples of water and clams from Parker River Refuge was examined bacteriologically.



College Park, Md.

Storage tests were begun on frozen oysters packed in a new, all-aluminum container and on frozen oysters and crab meat packed in a new fiber-body, metal-end container.

Tests were carried out on the insulating qualities of several containers. These containers, with various synthetic liners, will be used in experimental shipments of seafoods by air.

Analyses for thiamine (vitamin B_1) in striped bass and Alaska pink salmon by the rat-growth method were completed. Additional rats are being readied for control analysis of vitamin A in certain fish oils.

Palatability tests were conducted on nine lots of frozen oysters that had received various pretreatments, six lots of frozen oysters and 14 lots of frozen gray sea trout fillets in different packaging materials, 17 lots of fresh gray sea trout fillets, three lots of oysters on the half shell, two codfish recipes, and on various recipes developed especially for use in the school lunch program.

Various carbohydrates were tested for their effect on the production of antifungal substances by certain organisms grown in agar and liquid media. No one carbohydrate tried seemed to be more stimulating than the others.

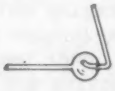
A lecture on air transport of seafoods was presented before a bacteriology class at the University of Maryland, and a demonstration of the packaging of fishery products for freezing was given for the foods class.

Thermal death times were determined for micrococci from crab meat. Bacteriological examinations were carried out on various samples of shucked oysters, oyster liquor, frozen shucked oysters, and on 25 samples of water, mud, and soil from a Patuxent Refuge lake.

Ketchikan, Alaska

Governor Gruening and other Alaskan and Federal officials met with industry representatives at Juneau on November 5 to take further steps in the mytilotoxine control study. The Fish and Wildlife Service undertook to plan an intensive survey of the mytilotoxine level of the Alaskan clam beds and to provide the necessary vessels, the Alaska Health Department agreed to lend personnel, and the Indian Service and the Alaska Development Board were to try to obtain funds for the work. The collection of clams was renewed late in the month. With the assistance of various packers, 35 different samples were obtained, extracted, and shipped to the Service's College Park, Md., laboratory for assay.

A newly organized food-packing company was assisted in the development of recipes for specialty items incorporating Alaska fishery products.



Seattle, Wash.

Personnel of a new Washington cannery were instructed in the operation of the canning machinery and a new circulating smokehouse that had been installed at the plant.

Tests were carried out on the analytical methods for determining oil in fish meal, the effects of storage conditions on the vitamin A content of grayfish livers, and the accuracy of the rapid tests for stability of vitamin A oils.

Seventy-five cans of commercially-packed Pacific rockfish were distributed to a home economics class for use as part of a meal at home. The members of the class will fill out consumer-acceptance questionnaires and return them to the laboratory for tabulation.

Storage tests were begun on a commercial seafood cocktail put up in different ways.

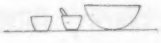
Samples of sardines canned experimentally in Maine and frozen pink salmon treated with N.D.G.A. were examined organoleptically.

At the request of the Bonneville Power Administration, a report was prepared on the possibility of establishing a sea-water magnesium plant in the Puget Sound area.

Cooked fish samples were analyzed for moisture, oil, and nitrogen. Pilchard meal samples were analyzed for oil content with various solvents to test the efficiency of different analytical methods and the effect of the aging of the meal.

The Service's third mobile laboratory was delivered to this laboratory by the outfitters. Also, there was received, on loan from the Quartermaster Corps, an Army trailer laboratory which will be used to provide additional working facilities for the scientific staff and as a mobile unit.

A considerable amount of time was devoted to assisting in the supervision of the outfitting of the factory vessel Pacific Explorer.



TRENDS IN THE FISHERIES

The trend of modern living encourages the processing of foods to a more advanced stage to simplify the task of meal preparation in the home. Technological advances have opened the way for improved methods of preserving perishable foods and for expanded use of byproducts.

As new equipment and packaging materials become more plentiful, there will be a tendency to freeze more fish products, to process them more rapidly, to store them at lower temperatures, and to package them in wrappers that are more attractive and that will resist loss of moisture or ingress of air. There will be emphasis on low bacterial counts and on other conditions that make for better quality.

--Fishery Leaflet No. 215

FRESH AND FROZEN FISH

New England

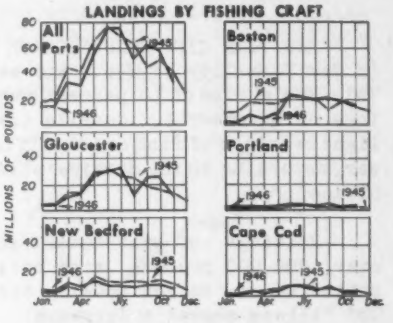
PRODUCTION: Production in all the major New England ports decreased during November, according to the Service's Market News Office at Boston. The total landings amounted to 33,206,000 pounds, a decrease of 21,130,000 pounds compared with October.

Those larger Boston trawlers fishing Georges and Channel Banks found fish scarce there. Consequently, only a few individual trips amounted to more than 100,000 pounds.

Pollock came into prominence at Boston and Gloucester during the last 2 weeks of the month with several heavy landings, but only 7,223,000 pounds of rosefish were landed at Gloucester compared with 20,852,000 pounds in October. Despite the decline in rosefish production, cold-storage plants at Gloucester reported nearly capacity holdings. Some consideration was given by interested parties to converting to other types of fishing.

* * * * *

LANDINGS DURING NOVEMBER: Landings by fishing craft at the ports of Boston, Gloucester, New Bedford, Portland, and on Cape Cod during November amounted to 36,510,000 pounds, valued at $2,822,165. This was a decrease of 12 percent in the volume of the landings compared with November 1945. Total landings at these ports during the first 11 months of 1946 amounted to 513,598,000 pounds, 6 percent below those for the corresponding period in 1945. Landings at Boston during the first 11 months were 33 million pounds less than those for the 11-month period in 1945. Gloucester showed an increase in landings of 3 million pounds; New Bedford and Cape Cod, 11.5 and 2.8 million pounds, respectively; while Portland increased 13.6 million pounds, according to Current Fishery Statistics No. 316.



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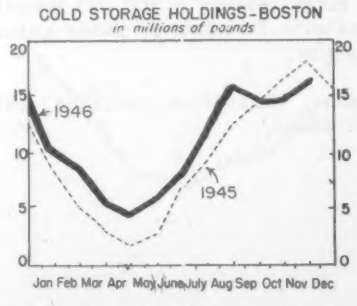
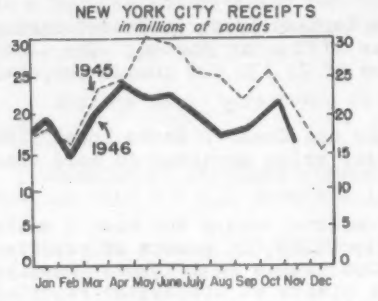
BOSTON COLD-STORAGE HOLDINGS: Holdings of fishery products in cold-storage plants in Maine and Massachusetts on November 30 amounted to 32,232,000 pounds, an increase of 2,417,000 pounds compared with October 31, according to the Service's Market News Office at Boston.



Despite the decline in production at the major New England ports during November, the movement of fish and fishery products into cold-storage during the month exceeded deliveries by 3,806,000 pounds. This is contrary to the normal movement at this time of year. Holdings of pollock fillets increased during November, reaching a total of 1,627,000 pounds on November 30.

Middle Atlantic

NEW YORK CITY RECEIPTS: Landings and receipts of fish and shellfish in New York City during November totaled 16,822,000 pounds. This was a decline of 26 percent compared with October and was 19 percent below November 1945, according to the Service's local Market News Office.



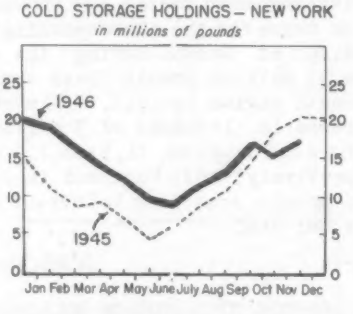
Compared with the previous month, fish receipts dropped 4⅛ million pounds, while those of shellfish declined 1⅛ million pounds.

The predominating species during the month were cod, haddock, hake, whiting, pollock, yellowtail, and flounder. Boston mackerel and salmon were received in good supply and also fresh and frozen halibut. Hard clams, oysters, scallops, and shrimp were the foremost shellfish items.

The normal November marketing pattern was followed, once again, this year. Throughout the first week of the month, the demand was good; from then on, the market weakened and was extremely sluggish the final week.

* * * * *

NEW YORK CITY COLD-STORAGE HOLDINGS: Holdings of fish and fishery products in New York City cold-storage warehouses totaled 17,235,000 pounds on December 1. This was a rise of 10 percent compared with holdings on November 1, despite the comparatively light receipts of fish and shellfish during November, according to the Service's local Market News Office.



Holdings of salt-water species increased over 900,000 pounds, with halibut, mackerel, sablefish, and salmon showing the largest gains. Cod fillets showed a decrease.

Shellfish stocks displayed an increase of 700,000 pounds compared with November 1.

The greatest rise occurred in shrimp holdings, which reached 1,300,000 pounds on December 1, an increase of 450,000 pounds compared with November 1. Other gains were recorded in lobster tails, sea scallops, and squid.

Fresh-water stocks showed only a slight increase. Whitefish declined, but holdings of cisco, sturgeon, and spoonbill cats increased.

Chesapeake

PRODUCTION: Landings of only 674,000 pounds of fish in the Hampton Roads area of Virginia in November 1946 were the lowest recorded for any month during the year by the Service's Market News Office at Hampton.

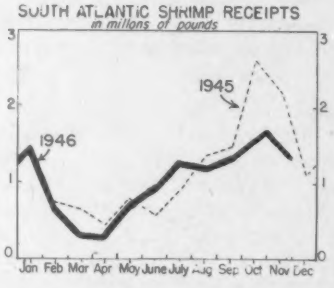
Similarly, light production was reported for the Beaufort-Morehead City area of North Carolina, also covered by the same office. Landings in this area amounted to 722,000 pounds during November compared with 1,687,000 pounds in October.

Production of fresh picked crab meat also showed a marked decline. The total production for November in the Virginia-Maryland areas amounted to 166,000 pounds compared with 268,000 pounds during October. This reduction has been attributed to the colder weather during the month, which retarded the movement of the crabs. Dredging for crabs is prohibited in Virginian waters, by State law, between April 1 and December 1.

Shucked oyster production increased from 246,738 gallons in October to 259,294 gallons in November.

South Atlantic

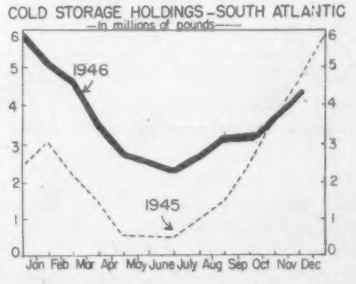
RECEIPTS: Shrimp production for Florida and the other South Atlantic States during November totaled 1,265,000 pounds (heads off), according to the Service's Market News Office at Jacksonville. This was a decline of 26 percent compared with October and 41 percent less than landings in November 1945. The only State in this section to show an increase over landings in November 1945 was South Carolina with a gain of 29 percent.



The decline in shrimp production during November has been due, in large measure, to bad weather at sea and a labor dispute at St. Augustine, Fla. During this period, no landings were made by the larger vessels.

* * * * *

COLD-STORAGE HOLDINGS: Stocks of fish and shellfish in five major cold-storage warehouses in the South Atlantic States totaled 4,184,000 pounds on December 1, according to the Service's Market News Office at Jacksonville. Compared with holdings on November 1, this was an increase of 484,000 pounds, but was 407,000 pounds less than December 1, 1945.



Items with stocks of 100,000 pounds or more were, in order of quantity: mullet, fillets of cod, haddock, pollock, and rosefish; shrimp, whiting, king whiting, and scup.

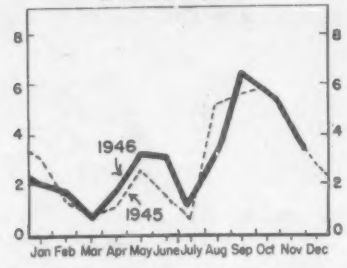
Holdings of fish increased 363,000 pounds, while shellfish stocks rose 121,000 pounds during November. The gain in fish holdings was due main-

ly to rises in stocks of mullet. Small increases were also noted in the inventories of croaker, grouper, halibut, scup, sea trout, and red snapper. Shellfish stocks were enlarged by heavier receipts of crabs, crab meat, shrimp, and lobsters. Shrimp holdings, however, are only about half those for the same period last year.

Gulf

PRODUCTION: Shrimp production in the Gulf area during November amounted to 28,958 barrels, 32 percent less than October and 17 percent below November 1945, according to reports received by the Service's Market News Office at New Orleans. Total landings for the 11 months ending November 30 were 2 percent below production during the corresponding period in 1945.

GULF SHRIMP RECEIPTS—
in millions of pounds



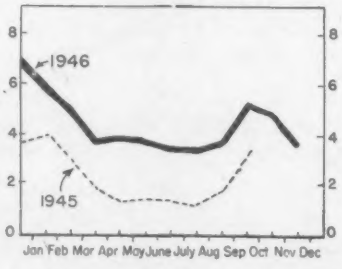
The peak month in shrimp production is October, consequently, the reduction in landings in November followed the regular seasonal downward trend.

The quantity of shrimp used for canning during November was three times greater than that in November 1945. For the first 11 months of 1946, more than double the shrimp were canned than during the corresponding period in 1945.

* * * * *

COLD-STORAGE: Shrimp holdings in 11 cold-storage warehouses in the Gulf States totaled 3,680,000 pounds on November 28, according to the Service's Market News Office at New Orleans. This represented an increase of 4 percent compared with October 31, but 18 percent less than on November 29, 1945. Approximately 1,800,000 pounds of shrimp were sent to cold storage during the month, and 1,650,000 pounds were withdrawn.

GULF COLD STORAGE HOLDINGS
in millions of pounds



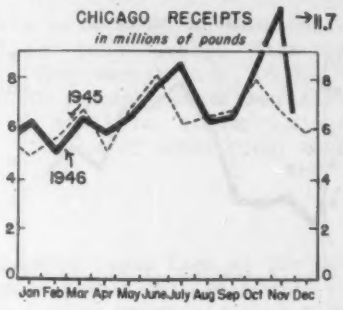
Holdings of frozen cooked and peeled shrimp amounted to 150,000 pounds on November 28. Stocks of these items on November 29, 1945, totaled 72,000 pounds.

Frozen salt-water fish holdings on November 28 totaled 1,925,000 pounds, 16 percent greater than those on November 29, 1945. The "in" movement and withdrawals during the month were approximately the same as for the previous month.

The leading species, in order of quantity held, were: mullet, rosefish fillets, whiting, and king whiting, cod fillets, and Spanish mackerel.

Great Lakes

CHICAGO RECEIPTS: Receipts of fresh and frozen fishery products in Chicago during November totaled 6,598,000 pounds, according to the Service's local Market News Office. This was a decline of 44 percent compared with October and 4 percent below November 1945.



Fresh-water receipts decreased 46 percent, and salt-water arrivals fell 47 percent compared with October. One of the chief reasons for this decline was poor consumer demand.

Closed season regulations in areas producing the bulk of lake trout and whitefish were responsible for the decline in arrivals of these varieties during November.

Shellfish receipts, amounting to 1,436,000 pounds, were 32 percent below those for October.

Transportation difficulties on the Pacific coast greatly curtailed arrivals from that area. However, despite the diminished receipts of halibut and salmon, the supply was quite sufficient to meet the demand.

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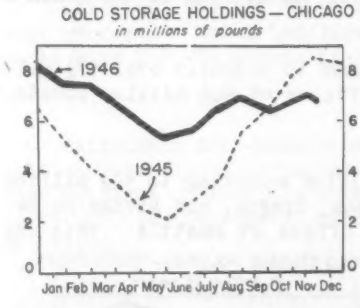
CHICAGO COLD-STORAGE HOLDINGS: Stocks of fishery products in Chicago cold-storage warehouses on November 27 amounted to 7,702,000 pounds, according to the Service's local Market News Office. This represented an increase of 7 percent compared with holdings on October 31 and was 8 percent below November 29, 1945.



Stocks of fresh-water fish totaled 1,900,000 pounds on November 27, 4 percent above the October 31 holdings, but 17 percent below those on November 29, 1945. Whitefish accounted for 491,000 pounds; lake trout, 314,000 pounds; and chubs, 289,000 pounds.

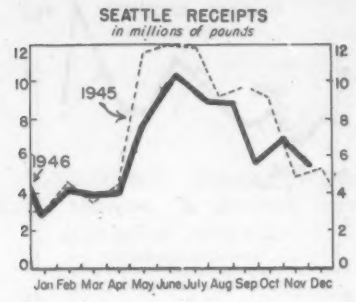
Holdings of salt-water varieties totaled 4,365,000 pounds, an increase of 4 percent compared with stocks on October 31, but were 2 percent below those on November 29, 1945. Rosefish and cod fillets, halibut, and salmon were the predominating species.

Shellfish stocks amounted to 1,437,000 pounds on November 27, 24 percent above holdings on October 31, but were 14 percent below November 29, 1945.

A slow movement of frozen fillets from cold storage followed heavy arrivals from the east coast. These holdings showed little change during October and November and were indicative that small deliveries were sufficient to accommodate the demand. Although the Pacific coast transportation situation was eased the latter part of November, wholesalers, realizing that local holdings were sufficient for the demand, did not rush to augment their stocks with west coast products.

Pacific

SEATTLE RECEIPTS: Landings of fresh and frozen fishery products at Seattle during November totaled 5,810,000 pounds, according to the Service's local Market News Office. This represented a decline of 15 percent compared with October, but was an increase of 18 percent over November 1945.



Receipts of salmon, amounting to 4¼ million pounds, represented 73 percent of all receipts. Purse seining and gill netting for chum salmon in Puget Sound were particularly productive, and these operations were responsible for the delivery of more than 4 million pounds of this species during the month. In addition, moderate quantities of silver and king salmon were landed, with Indian gear accounting for a good portion of the catch.

Operations of the long-line fleet drew to a close after a fairly successful season. Twenty-seven vessels landed 375,000 pounds of sablefish and 55,000 pounds of incidentally-caught halibut, together with moderate catches of mixed cod.

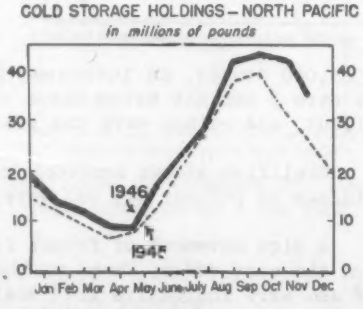
The otter-trawl operators, after settling a number of irritating labor and price disputes, were further retarded by storms and rough weather on the offshore banks.

As the result of the maritime dispute, which kept the Puget Sound region closed for all sea-going shipping during November, no direct shipments of Alaskan products were made to Seattle. This was partially responsible for the decline in the month's receipts.

Receipts for the first 11 months of 1946 amounted to slightly over 73¼ million pounds, 13 percent below the comparable 1945 figure of 84⅛ million pounds.

* * * * *

NORTHWEST COLD-STORAGE HOLDINGS: Fish and shellfish amounting to 34⅛ million pounds were held in cold-storage plants in Washington, Oregon, and Alaska on December 1, according to the Service's Market News Office at Seattle. This was 7 million pounds less than stocks on November 1, but was 8 million pounds greater than those on December 1, 1945.



The region's holdings were credited to various sections as follows: Alaska, 60 percent, which included a half million pounds of United States-owned fish in Prince Rupert, British Columbia; Washington, 27 percent; and Oregon, 13 percent.

The maritime dispute continued to tie up coastwise shipping in the Puget Sound area, with the result that none of the 7-million pound reduction in Alaska's holdings landed directly at Seattle. The greater portion of the north-frozen fish was shipped to various Canadian ports and sent by rail to eastern or southern markets.

Freezings during November were heaviest in Washington, where over 2¼ million pounds were placed in the warehouses. Of this amount, 1⅛ million pounds of chum salmon and nearly 300,000 pounds of sablefish were frozen in Puget Sound area plants. Trawling was poor off both the Oregon and Washington coasts, resulting in very small groundfish freezings.

All items showed materially reduced inventories on December 1, with halibut and sablefish displaying a decline of half a million pounds each. Five items accounted for 96 percent of the region's holdings. They were salmon, 16,374,000 pounds; halibut, 9,576,000 pounds; sablefish, 4,610,000 pounds; groundfish fillets, 961,000 pounds; and rockfishes, 724,000 pounds. In addition, nearly 3,812,000 pounds of mild-cured salmon were in cold storage. Stocks of other fish, shellfish, and cured products were relatively small.

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RECEIPTS AT SOUTHERN CALIFORNIA PORTS: Landings of fresh fish at the ports of San Pedro and Santa Monica showed a decline of more than a million pounds during November as compared with October, according to the Service's Market News Office at San Pedro. Only 797,000 pounds of mackerel were landed during November compared with 2,260,000 pounds in October. This decrease, however, was partially offset by landings of 511,000 pounds of sardines in November.

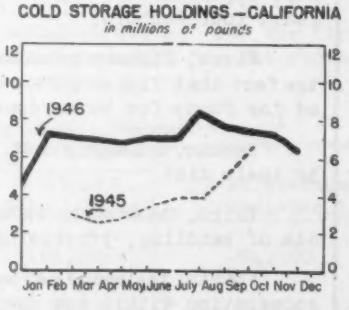
Landings at San Diego during November were only half the October total. A decrease was noted in nearly all species landed, but the sharpest declines were noted in barracuda, with 15,000 pounds; California halibut, with 24,000 pounds; black sea bass, with 6,000 pounds; swordfish, with 335 pounds; and yellowtail, with 29,000 pounds. The only sizable increase occurred in mackerel landings, 43,000 pounds, compared with 12,000 pounds in October.

Likewise, Newport Beach showed decreases in nearly every species landed, except mackerel. Total landings during November amounted to 161,000 pounds, compared with 219,000 pounds in October.

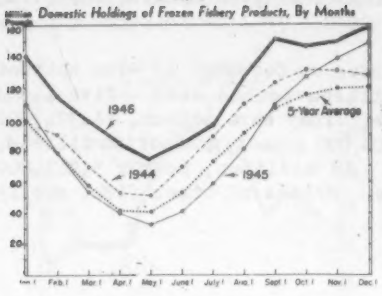
* * * * *

CALIFORNIA COLD-STORAGE HOLDINGS: Stocks of fish and shellfish in California cold-storage plants on December 1 totaled 6,602,000 pounds, 741,000 pounds less than holdings on November 1 and 1,633,000 pounds less than December 1, 1945, according to the Service's Market News Office at San Pedro.

During November, 334,000 pounds were frozen compared with 322,000 pounds in October. Freezings of bait and animal food increased during November. This was the result of large quantities of sardines and mackerel in the San Pedro area being bought by various fresh fish dealers and sold in sizable quantities for freezing purposes; and two sardine vessels landing large quantities of sardines at Santa Barbara, from which point the fish were sent to Monterey to be frozen for bait.



United States



COLD-STORAGE FREEZINGS AND HOLDINGS: Domestic stocks of frozen fish and shellfish reached a record total of 158,486,000 pounds on December 1. Five items accounted for nearly 50 percent of the total holdings. These were salmon, 21.9 million pounds; halibut, 16.3 million pounds; rosefish fillets, 15.5 million pounds; shrimp, 13.8 million pounds; and cod fillets, 10.5 million pounds, according to Current Fishery Statistics No. 306.

POSTWAR OUTLOOK IN THE FISHERY INDUSTRIES

All industries are projecting plans for maintaining the high productivity achieved during the war. They are seeking every means to convert their productive capacity into products and services that consumers will buy and use. The marketing skill of all industries is concentrated on developing methods for obtaining the fullest utilization of their commodities. With each industry seeking for its products a share of the consumer's dollar, competition for consumer markets will be greater than ever before.

From what we know at present, it appears that the fisheries will have greater domestic and foreign competition than they have ever before experienced. The future success of the fisheries depends upon at least four factors.

First, fishery producers and distributors must learn to appreciate the fact that fish as a food must meet the highest requirements established for foods for human consumption.

Second, consumers must be convinced of the value of fishery products in their diet.

Third, the fishery industries must seek out and adopt improved methods of handling, processing, and utilizing the catch.

Fourth, the need is apparent for the continued development of genuine cooperation within the industry.

--Fishery Leaflet No. 215

CANNED AND CURED FISH

Pilchard

PILCHARD PACK: Pilchard (California sardine) landings totaled 49,040 tons during November 1946, according to reports of the California Sardine Products Institute and the California Division of Fish and Game. This resulted in a canned pack of 627,872 actual cases from November 1-28. The canned production for the 1946-47 season to November 28 continued to lag behind the 1945-46 season with only 1,796,651 cases packed. The canned production from November 3 to December 1, 1945, was 634,758 cases.

California Sardine Landings, Canned Pack and Byproducts

		MONTH		SEASON	
		1946	1945	1946-47	1945-46
Item	Unit	November	November	Aug.1-Nov.30	Aug.1-Nov.30
Landings	Tons	49,040	65,890	158,391	320,188
		Nov.1-28	Nov.3-Dec.1	Aug.1-Nov.28	Aug.1-Dec.1
Canned	1 lb.ovals-48 per case	137,031	158,363	378,632	925,576
	1 lb.talls-48 per case	467,534	458,245	1,344,624	1,789,936
	½ lb.fillets-48 per case	97	-	7,806	-
	½ lb.round-96 per case	3,992	10,562	25,424	34,620
	Unclassified	19,218	7,588	40,165	90,961
	TOTAL, Actual cases	627,872	634,758	1,796,651	2,841,093
		November	November	Aug.1-Nov.30	Aug.1-Nov.30
Meal	Tons	6,692	8,816	21,184	45,712
Oil	Gallons	873,520	1,403,751	3,323,572	10,196,208

Shrimp

SHRIMP PACK: During November 1946, 35,882 standard cases of shrimp were packed, according to reports received from canning plants operating under the Seafood Inspection Service of the Food and Drug Administration. For the first 11 months of 1946, the canned production was more than double that for the corresponding period in 1945, with 217,353 standard cases packed.

Wet and Dry Pack Shrimp in all Sizes in Tin and Glass--Standard Cases*

MONTH		SEASON		
1946	1945	1946-47	1945-46	3-yr.average
Nov.3-30	Nov.4-Dec.1	July 1-Nov.30	July 1-Dec.1	July 1-Dec.1
35,882	15,767	217,353	101,316	274,500

*All figures on basis of new standard case--48 No. 1 cans with 7 oz. per can in the wet pack and 6½ oz. per can in the dry pack.

Tuna and Mackerel

TUNA AND MACKEREL PACK: The production of canned tuna by California packers during November 1946, amounted to 192,393 standard cases, a decrease of 44 percent below the October pack and 30 percent under that of November 1945, according to information released by the California Division of Fish and Game. The total tuna pack for the first 11 months of the current year--4,132,191 cases--was 26 percent above that of the corresponding period in 1945.

The November mackerel pack amounted to 123,375 standard cases, 17 percent above the October production, but 32 percent less than November 1945. The 11-month total of 423,703 cases was 14 percent below that for the corresponding period in 1945.

California Pack of Tuna and Mackerel--Standard Cases*

Item	November 1946	October 1946	November 1945	Eleven mos. ending with Nov.-- 1946	1945
	Cases	Cases	Cases	Cases	Cases
Tuna:					
Albacore	3,466	23,117	9,508	385,662	473,624
Bonito	9,713	17,571	9,351	93,318	46,711
Bluefin	354	5,220	557	313,547	265,051
Striped	18,000	87,271	86,794	595,395	471,873
Yellowfin	143,300	146,276	126,302	1,879,765	1,279,724
Yellowtail	2,521	4,282	3,161	43,054	13,807
Flakes	15,039	59,244	40,901	821,450	705,343
Tonno style	-	-	-	-	16,198
Total	192,393	342,981	276,574	4,132,191	3,272,331
Mackerel	123,375	105,103	181,485	423,703	490,736

*Standard cases of tuna represent cases of 48 7-ounce cans, while those of mackerel represent cases of 48 1-pound cans.

ORIGIN OF THE CANNING INDUSTRY

A number of individuals contributed to the early development of the canning industry. Although national pride with its consequent tendency to bias often places varying emphasis on the importance of the contributions, it is generally agreed that the original inventor of the art of canning was Nicolas Appert, a Frenchman, and that the basic methods of the industry are the result of his work.

Canning was first developed on an extensive commercial scale in the United States and most of our pioneer canners were primarily packers of fish and seafoods; packing fruits, vegetables, and preserves as secondary or incidental items. Strangely enough, the packing of fishery products presents more difficulties than processing other types of foods.

--Fishery Leaflet No. 78

FISHERY BYPRODUCTS

Oil and Meal

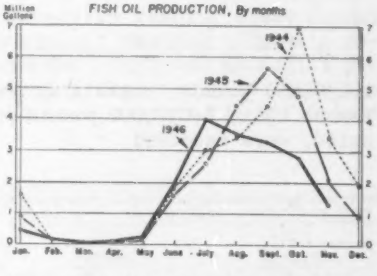
PRODUCTION: Small catches of pilchards in the Monterey district of California and no production whatsoever in the San Francisco Bay area during October held the domestic yield of fish meal for the month, by firms reporting to the Fish and Wildlife Service, to 20,123 tons, compared with 26,122 tons for October 1945. The production of fish oils showed a similar decline, totaling only 2,801,395 gallons during October, compared with 4,796,610 gallons in October 1945, according to Current Fishery Statistics No. 308.

Because of the failure of the pilchard fishery in the Monterey and San Francisco districts, the peak production of fish oil during 1946 occurred in July, when about 4 million gallons were produced. Normally, the month of peak production is September or October, when large yields of pilchard, menhaden, and herring oils combine to raise the monthly production to from 5 to 7 million gallons.

The total yield of fish meal during the first 10 months of 1946 by firms which normally account for 94 percent of the production amounted to 149,494 tons, 5 percent below the yield for the same period in 1945, while the production of fish oils amounted to 16,574,408 gallons, 20 percent below the 10-month yield in 1945.

* * * * *

PRODUCTION: The failure of the pilchard (sardine) fishery in northern California continued to hold the yield of fish scrap and meal below the previous year. During November, 13,283 tons of fish scrap and meal were produced by firms reporting their operations monthly, compared with 15,535 tons in November 1945. The production of fish oils showed a similar decline, totaling only 1,330,637 gallons during November compared with 2,140,174 gallons in November 1945, according to Current Fishery Statistics No. 312.



The total yield of fish scrap and meal during the first 11 months of 1946, by firms which normally account for 94 percent of the domestic production, amounted to 162,897 tons, 6 percent below the yield for the corresponding period in 1945, while the total production of fish body oils amounted to 17,944,196 gallons, 21 percent below the 11-month yield in 1945.

The greater percentage decline in the production of oils is accounted for by the failure of the northern California pilchard fishery, where the fish normally yield large quantities of oil.

Preliminary data indicate that the 1946 catch of menhaden, which may have exceeded 900 million pounds (1.3 billion fish), was the largest on record. The previous high occurred in 1922, when the catch amounted to 812 million pounds.

Vitamin A

STOCKS AND PRODUCTION: Stocks of vitamin A in fish-liver oil on September 1 were reported at 49.5 trillion units, an increase of 6 percent above stocks held on August 1, but 4 percent less than those on September 1, 1945.

Production of vitamin A during August totaled 7.6 trillion units compared with 6.6 trillion units produced in August 1945. Total production during the first 8 months of 1946 amounted to 41.7 trillion units compared with 41.6 trillion units produced during the corresponding period of 1945.

Receipts of livers during August totaled 1,637,000 pounds containing about 6.9 trillion units of vitamin A. During August 1945, 1,437,000 pounds of livers, having a vitamin A content of 7.3 trillion units, were received, according to Current Fishery Statistics No. 298.

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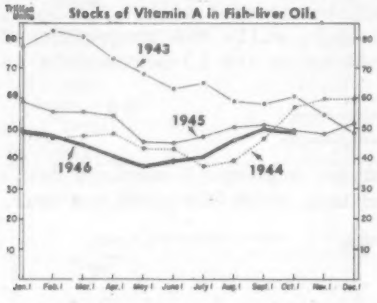
STOCKS AND PRODUCTION: Stocks of vitamin A in fish-liver oil on October 1 were reported at 48.8 trillion units, a decrease of 1.5 percent below stocks held on September 1, and 1 percent less than those on October 1, 1945, according to Current Fishery Statistics No. 303.



Production of vitamin A during September totaled 4.1 trillion units compared with 4.8 trillion units produced during September 1945. Total production during the first 9 months of 1946 amounted to 45.8 trillion units compared with 46.4 trillion units produced during the corresponding period of 1945.

Receipts of livers during September totaled 1,437,000 pounds, containing about 5.3 trillion units of vitamin A. During September 1945, 1,037,000 pounds of livers, having a vitamin A content of 5.1 trillion units, were received.

OTHER FISHERY NOTES

Additions to the Fleet of U.S. Fishing Vessels

Eighty-eight vessels received their first documents as fishing craft during November 1946, according to information released by the Bureau of Customs. This brought the total number of craft receiving their first documents as fishing vessels during the first 11 months of 1946 to 1,018, compared with 698 in the same period of 1945. An additional 114 vessels were redocumented as fishing craft during the first 11 months of 1946.

Vessels Obtaining Their First Documents as Fishing Craft

Section	November		Eleven months ending with Nov.		Total,
	1946	1945	1946	1945	1945
	Number	Number	Number	Number	Number
New England	9	3	81	67	70
Middle Atlantic	9	5	68	45	48
Chesapeake Bay	11	4	66	53	55
South Atlantic and Gulf	34	23	329	222	240
Pacific Coast	17	5	356	238	244
Great Lakes	6	8	71	49	60
Alaska	-	-	19	5	5
Hawaii	2	-	13	1	1
Unknown	-	-	15	18	18
Total	88	48	1,018	698	741

Note: Vessels documented by the Bureau of Customs are craft of 5 net tons and over.
Source: Monthly Supplements to Merchant Vessels of the United States, Bureau of Customs.

* * * * *

A total of 1,201 vessels were added to the domestic fishing fleet during 1946, according to information released by the Bureau of Customs. Vessels receiving their first documents as fishing craft numbered 1,085, and an additional 116 vessels were redocumented as fishing craft during the year. In 1940, the total number of fishing vessels of 5 net tons and over, operated in the United States and Alaska, amounted to 5,562 craft.

Vessels Obtaining Their First Documents as Fishing Craft

Section	December		Twelve months ending with December	
	1946	1945	1946	1945
	Number	Number	Number	Number
New England	5	3	86	70
Middle Atlantic	6	3	74	48
Chesapeake Bay	5	2	71	55
South Atlantic and Gulf	22	18	351	240
Pacific Coast	19	6	375	244
Great Lakes	5	11	76	60
Alaska	-	-	19	5
Hawaii	4	-	17	1
Unknown	1	-	16	18
Total	67	43	1,085	741

Note: Vessels documented by the Bureau of Customs are craft of 5 net tons and over.
Source: Monthly Supplements to Merchant Vessels of the United States, Bureau of Customs.

FAO Fisheries Division

The Food and Agriculture Organization has forwarded to member governments a Progress Report and Summary of its 1947 Program. That portion relating to the Fisheries Division, which is directed by Dr. D. B. Finn, follows:

"In accordance with the recommendations of the Standing Advisory Committee on Fisheries, which held its first meeting at Bergen in August 1946, and of the second session of the Conference, the work of the Division, which is responsible for all FAO activities relating to fish and fisheries, will be divided amongst three branches: Fishery Economics, Fishery Biology, and Fishery Technology.

"Fishery Economics Branch will be concerned with the equilibrium of production, distribution and consumption of fish, and with economic efficiency within the limits of fishery activities. The economic relationship of fish with food in general is a responsibility of the Economics Division. The work of the branch will initially be divided into three parts:

"(a) Statistics, including the development of common conversion factors and of methodology in the less advanced countries, as well as the collection and collation (in collaboration with Statistics Division) of statistical material in its present form;

"(b) Production and consumption studies, undertaken in cooperation with governments;

"(c) International trade, including studies in the significance of fishery products in international trade and the effect of limiting factors.

"The work of Fishery Biology Branch will be divided into (a) marine biology and (b) fresh water biology, and will ultimately cover fish cultural methods, hydrography, oceanography, and meteorology.

"Fishery Technology Branch will initially include the following subdivisions:

"(a) Fishing methods;

"(b) Fish processing;

"(c) Fishery by-products;

"(d) Fishery engineering, including the application of engineering science both to the catching, processing, transport, storage, and distribution of fish and to river and lake management.

The branch will, no doubt, be called on to provide governments with technical advice, either through the services of its own staff or through arranging for the loan of experts by one government to another. This will be facilitated by compilation of a world directory of fishery experts.

"The work of the Division in assembling recorded knowledge, assisting in its dissemination, determining the gaps in existing knowledge, stimulating measures to fill the gaps and making recommendations for action will depend for its success on liaison with government departments and other national and international organizations. Full advantage will be taken of facilities provided by national FAO committees and regional offices.

"Steps have already been taken to develop cooperation. Mr. P. D. H. Dunn, Fisheries Secretary for England and Wales, who has been closely associated with the work of FAO since its inception, has been appointed as adviser to the Fisheries Subcommittee of the Emergency Economic Committee for Europe. The Director of the Division was present at a meeting of the International Council for the Exploration of the Sea held at Stockholm in August 1946 and made arrangements with the Chairman and the Secretary-General of the Council for coordination of its work with that of FAO. The Director also attended at Bergen in September an international meeting of the salt fish trade, which is seeking to form an international association with objects that are in accordance with the aims of FAO. He also represented FAO at the International Whaling Conference in Washington in November. Measures for continuance of the work of the Fisheries Rehabilitation Division of UNRRA are under discussion.

"Arrangements are contemplated for members of the staff of the Division to visit certain countries in order to assist in developing latent fishing resources. Plans are also under way for a world fishery census in 1950, and a start has been made by the Economics Branch in making special studies of fish products in relation to commodity arrangements."

Fishery Leaflet 200

This leaflet, prepared by the Division of Information, Fish and Wildlife Service, lists the titles and numbers of all fishery leaflets from 1 to 200. These publications cover such subjects as angling laws; baits; preservation and care of fish nets; fish culture; fish ponds; various fish and shellfish in their respective areas; marine predators; Irish moss, sponges; care of aquarium fishes; food value of fish and shellfish; fish cookery; home preservation of fishery products; refrigeration of fish; unemployment insurance for fishermen; and many more.

Copies of this publication may be obtained, free of charge, from the U. S. Fish and Wildlife Service, Department of the Interior, Merchandise Mart, Chicago 54, Ill.

Fishery Products Purchased by Army Qartermaster Corps

Purchases of fishery products by the Army Quartermaster Corps' 12 market centers during the years 1943 to 1946, inclusive, totaled more than 199 million pounds. Procurements during 1946 amounted to 25,146,425 pounds, a decline of 54 percent under those of 1945. A tabulation of the purchases by months is shown on page 40.

During September, October, and November 1946, the Army's procurement of fishery products exceeded its meat purchases; however, during these months, meat was in extremely short supply. Following the return of meat to the markets, the Army's

purchases of fish declined. This was reflected in its December purchases, which were 56 percent less than those in November.

Month	1943	1944	1945	1946
	Pounds	Pounds	Pounds	Pounds
January	3,764,722	3,717,261	2,928,254	4,442,020
February	3,924,502	5,247,017	2,500,989	2,377,388
March	4,113,493	4,611,690	3,844,308	1,792,728
April	3,357,874	7,612,747	4,958,707	731,807
May	4,033,638	9,034,419	5,378,541	690,120
June	5,902,756	8,772,073	7,941,247	1,298,044
July	5,682,422	5,705,824	4,753,443	1,534,121
August	5,650,140	4,987,699	4,893,007	1,747,690
September	4,018,787	2,348,852	4,275,587	2,943,477
October	4,866,451	3,073,230	3,011,802	3,214,982
November	6,189,080	5,839,746	4,132,875	3,037,957
December	4,200,151	3,279,844	5,499,304	1,336,091
Totals	55,704,016	64,230,402	54,118,064	25,146,425

Preliminary Procedures for the Analysis of Vitamin A in Fishery Byproducts

In June 1944, technical representatives of the vitamin A industry and officials of State and Federal Government agencies interested in fishery byproducts met at San Francisco and worked out uniform, unofficial procedures for determining the oil content of raw materials containing vitamin A and for preparing the solvent extract used for the spectrophotometric determination of the content of vitamin A.

These procedures, listed below, have been successfully employed to facilitate the trade in materials containing vitamin A.

"It is assumed that the material has been presented for analysis in the form of a sample consisting of one pint of material representative of the lot in question. It is not assumed that this material, as received, is fully ground for analysis.

Preparation of Sample

"Entire sample should be homogenized in a Waring Blender or any similar disintegrating device, the treatment being continued until the mass is freed of lumps and is of entirely uniform consistency throughout.

"Duplicate sub-samples for analysis should be obtained while the mass is still being agitated, using a pipette or hypodermic syringe approximately calibrated to deliver 5 ml. of material for method A and 10 ml. for method B, the entire delivery being used for each sample.

Analysis

Method A

"1. If the material is estimated to contain 40% fat or over, samples should be placed in tared centrifuge bottles of approximately 125 ml. capacity provided

with tight fitting extracted corks (corks should be extracted to such an extent as to have no effect on the optical density of the solvent), and the sample weights determined to within 0.01 gram.

"2. Approximately 20 grams of pulverized, neutral, anhydrous sodium sulfate and exactly 50 ml. of petroleum ether (Skellysolve F, or equivalent grade) are added to the sample, which is immediately tightly stoppered and shaken until the vitamin A and oil are in complete equilibrium with the solvent phase. It is deemed impractical to specify the exact time and technique of shaking to be used by each Laboratory, but the completeness of the extraction should be determined when the method is first undertaken by examining aliquots drawn after different periods of shaking. For subsequent use an adequate safety factor should be added to the time necessary to produce equilibrium.

"3. When equilibrium is obtained, the solvent layer should be inspected and, if found to be free from all turbidity, aliquots for vitamin A and fat may be drawn. If turbidity persists in the solvent phase, the entire mass should be centrifuged until a clear solvent layer is obtained.

"A 5 ml. aliquot is transferred to a volumetric flask and suitably diluted with 'anhydrous' isopropanol for spectrophotometric examination.

"4. A 10 ml. aliquot is pipetted into a tared flask and rendered free of solvent by heating on a water-bath until boiling ceases and thereafter heating in an air oven at 105° C. or a vacuum oven correspondingly adjusted, for not less than ten nor more than sixty minutes, cooled in a desicator and weighed to within 0.001 gram.

"5. The percentage of oil in the sample is calculated by the following formula in which S = sample weight and W = weight of oil in aliquot:

$$\% \text{ oil} = \frac{5000\ W}{10S - \frac{(WS)}{(0.92)}}$$

"6. The sample weight to be used in calculating E (1%, 1 cm) is $\frac{1}{2}$ of the weight of oil derived from the 10 ml. aliquot.

Method B

"1. If the material is estimated to contain less than 40% oil, samples should be placed in tared 100 ml. beakers and weighed to nearest 0.01 gram.

"2. An excess of pulverized, neutral, anhydrous sodium sulphate and approximately 1 teaspoonful of diatomaceous earth are added, and the mass thoroughly mixed. The use of materials that absorb vitamin A shall be avoided.

"3. Four extractions are performed with 30 to 40 ml. of petroleum ether (Skellysolve F, or equivalent grade), stirring thoroughly and decanting after each extraction into 250 ml. volumetric flask.

"4. Treatment is continued by adding 2-3 grams of washed sand (rendered fat-free by ignition), transferring the residue from previous extraction to a glass mortar, and extracting three or four additional times with petroleum ether, grinding thoroughly each time and decanting to the 250 ml. flask. The extract is then made to volume and mixed.

"5. Aliquots are withdrawn and analysis completed as in Sections 3 and 4, Method A, except that in this instance a 50 ml. aliquot is used for oil determination.

"6. Calculate oil content by the following formulae:

$$\frac{\text{Wt. of oil in aliquot} \times 5 \times 100}{\text{Wt. of sample}} = \% \text{ oil in sample}$$

"Weight of oil for E (1%, 1 cm) measurement = 1/10 of weight derived from aliquot."

Protection for Fishermen

Immersion in ice-cold water long has been one of the principle hazards of fishing. Many men, swept from the decks of fishing boats, have never been found alive, because the shock of icy water was too much for them to stand. Recently discovered experiments in Germany may solve this problem.

Shortly after the close of hostilities in Europe, four American technicians were sent to Germany to collect technical and research data and to survey every phase of the German textile industry. Nearly every textile center in the American, British, and French occupied territory was visited.

According to the preliminary reports of the technicians, which were published in the January 1946 issue of Textile Manufacturer, Manchester and London, England, it was not always easy to get the information desired. Germany's big cities and industrial centers, with few exceptions, suffered heavily in the war. Sometimes documents and records had to be dug out of salt mines or hay lofts or from under wood piles as far as 150 miles away from the plants to which they belonged.

Extracts from the technicians' findings with regard to immersion suits follow:

A great deal of effort has been directed to the protection of men in cold water. Research has been instigated by various institutions in the United States and England. These efforts were mostly directed towards extremely tight-woven fabrics, with a sufficient water repellent finish or coating to keep the water away from the skin of an immersed person. These efforts have gone as far as using clothing made of leather with a waterproof coating, none of which have proved entirely satisfactory.

This problem was attacked in Germany from a completely different angle than in the United States or England. It was thought essential that a suit of clothing should be constructed which is permeable when dry, so as not to hinder body movements or make the wearer hot, and yet enable the person immersed in cold water to survive for many hours.

It was thought that the best way to solve this problem was to build a suit in which the cold water which penetrated into the clothing would be forced out again by a stabilized foam, which develops quickly inside this protective suit.

Loss of body heat to water would be considerably reduced by the air bubbles in the foam. When some of these suits were tried out, it showed that a stay of 24 hours in ice-cold water was not at all harmful.

It was necessary to develop a strong and stable foam, and the best result could be obtained with a carbon dioxide forming mixture of sodium bicarbonate with an acid. To avoid body irritation, an organic acid, harmless to the skin; was mixed with bicarbonate in molecular proportion. The mixture should not be hygroscopic. Citric acid proved particularly suitable; it dissolves quickly in cold sea water, so that a foam rapidly develops and as it is a tribasic acid, it gives a high yield, and, therefore, allows a large equivalent quantity of bicarbonate to be worked into the mixture so that a good deal of carbon dioxide can be developed. The best foam medium proved to be a particular Mersolate--type H 30--low in salt content.

The best formula worked out at I.G. Farben at Hoechst was foam powder No. 4, which contained 24.4 percent Mersolate H 30 (30% H_2O) low in salt content; 41.40 percent sodium bicarbonate; 34.14 percent citric acid.

A complete suit consists of trousers, jacket, gloves, and shoes. This was considered better than a one-piece suit, because it could be put on and taken off more easily and was more comfortable. The collar was made of foam rubber which, normally, was kept open and when necessary, closed tightly very quickly by merely pulling a cord. A sort of life belt was worn around the neck which kept the head out of the water.

The production of these suits was intended for the Air Force as well as the Navy and, as the first field tests proved quite successful, an increase of production was planned just before the fighting ceased. It is claimed that suits which were used could be opened, washed out, dried, again filled with powder, and then sewed together and used again.

To construct such an immersion suit, three layers of cloth were used. On the outside, a filament acetate poplin; next, an acetate plush with pile towards the outside; then a viscose filament tightly-woven fabric. The acetate did not swell or absorb a lot of water and permitted the sea water to penetrate quickly to the foam powder, which produced foam immediately. The inner layer of viscose did swell and tighten and kept most of the water away from the body. The foam powder was rubbed into the pile of the plush by hand, at the rate of 4.4 pounds per suit.

Canadian Provincial Fisheries Department Report, 1945

The value of the fishery products of Canada for the year 1944 totaled $89,418,451. During that year British Columbia produced fishery products to the value of $34,900,990, or 39 percent of Canada's total. British Columbia in 1944 led all the Provinces in the Dominion in respect to the production of fisheries wealth. Her output exceeded that of Nova Scotia, the second in rank, by $11,238,935.

The total canned salmon pack canned in British Columbia in 1945 amounted to 1,739,312 cases, according to annual returns submitted to the Provincial Fish-

eries Department by the licensed canners. This was 641,755 cases greater than the number canned in the year previous, but in 1944 the salmon pack in British Columbia was the smallest since the depression years of 1931-32.

Provincial Fisheries Department Report, 1945 (with Appendices), contains in addition to the above information, an account of the capital, equipment, and employees in the British Columbia fisheries; the canned salmon pack for British Columbia in 1945 by districts; other canned packs such as pilchard, herring, and shellfish; and net fishing in non-tidal waters. In the Appendices of the publication, such subjects are discussed as: Contributions to the Life-History of the Sockeye Salmon; Tagging of Herring in British Columbia--Insertions and Recoveries During 1945-46; Condition of the Butter-Clam Fishery in British Columbia. The report on investigations of the International Pacific Salmon Fisheries Commission for 1945 and the salmon-spawning report for British Columbia for 1945 also have been included.

Report on International Whaling Conference

"The International Whaling Conference met in Washington, D. C., on November 20, 1946. The Governments of Argentina, Australia, Brazil, Canada, Chile, Denmark, France, Netherlands, New Zealand, Norway, Peru, Union of Soviet Socialist Republics, United Kingdom of Great Britain and Northern Ireland, and the United States of America were represented by plenipotentiary delegations; and the Governments of Iceland, Ireland, Portugal, Sweden, and the Union of South Africa were represented by observer delegations. Remington Kellogg, chairman of the delegation of the United States, was elected permanent chairman of the Conference, and Ira N. Gabrielson, member of the delegation of the United States was elected vice chairman. The final session was held on December 2, 1946. As a result of the deliberations of the Conference, the following instruments were formulated and opened for signature on December 2, 1946, to remain open for 14 days thereafter:

"1. International Convention for the Regulation of Whaling.

"2. Protocol for the Regulation of Whaling.

"The Protocol contains the regulations applicable to the whaling season 1947-48 and includes all the provisions of the Protocol for the Regulation of Whaling signed in London on November 26, 1946, to apply as if in the said Protocol the words 'season 1947-48' were substituted for the words '1 May 1947, to 31 October 1947.' This Protocol will come into force when notifications of acceptance thereof shall have been given to the Government of the United States of America by all the Governments, parties to the Protocol of November 26, 1946.

"The Convention, which includes a schedule, provides for a long-term agreement, to become effective July 1, 1948. The Convention shall, when instruments of ratification have been deposited by at least six signatory governments, which shall include the Governments of the Netherlands, Norway, the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland, and the United States of America, enter into force with respect to those governments and shall enter into force with respect to each government which subsequently

ratifies or adheres on the date of deposit of its instrument of ratification or the receipt of its notification of adherence.

"The Convention provides for the establishment of an International Whaling Commission to be composed of one member from each contracting government. This commission shall elect from its own members a chairman and vice chairman and shall determine its own rules of procedure. Recognizing that specialized agencies related to the United Nations will be concerned with the conservation and development of whale fisheries and the products arising therefrom and desiring to avoid duplication of functions, the contracting governments will consult among themselves within 2 years after the coming into force of this Convention to decide whether the commission shall be brought within the framework of a specialized agency related to the United Nations.

"The Convention provides that each contracting government shall take appropriate measures to insure the application of the provisions of the Convention and the punishment of infractions against the said provisions in operations carried out by persons or by vessels under its jurisdiction. The Convention also provides that no bonus or other remuneration shall be paid to gunners and crews of whale catchers for any illegal whales taken.

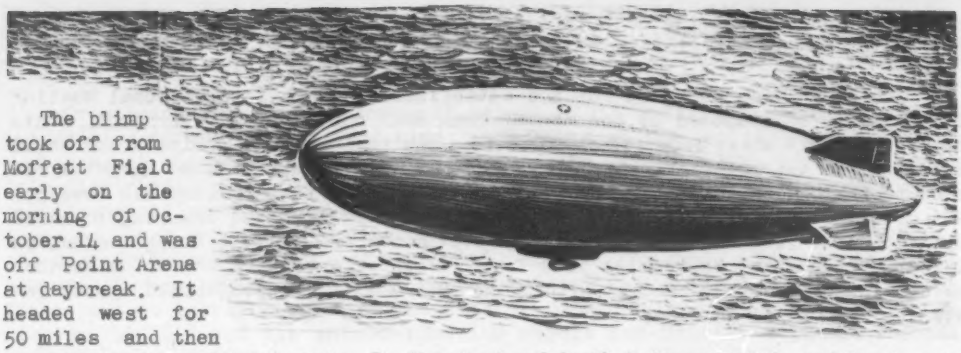
"The schedule, which is part of the Convention, provides that at least two inspectors shall be maintained on each factory ship for the purpose of maintaining 24-hour inspection, and that adequate inspection shall be maintained at all land stations. The schedule also forbids the taking of gray whales or right whales and the killing of calves or female whales accompanied by calves. The schedule forbids the killing of any blue, fin, sei, humpback, or sperm whales below the following respective lengths: 70, 55, 40, 35, or 35 feet. The schedule requires that copies of all official laws and regulations relating to whales and whaling and changes in such laws and regulations be transmitted to the commission. The schedule provides that the maximum catch taken during any whaling season should not exceed 16,000 blue-whale units and that blue-whale units shall be calculated on the basis that one blue whale equals (1) two fin whales or (2) two and a half humpback whales or (3) six sei whales."

--Coast Guard Bulletin, February 1947.

Scouting for Sardines from Navy Blimp

A search for sardine schools off the coast of central California was undertaken by a Navy blimp from Moffett Field on October 14, 16, 17, 18, and 28. The search was requested by the San Francisco Sardine Industry, whose representative accompanied all five flights. In addition, a representative of the California Division of Fish and Game was aboard the blimp on the first three flights and a Fish and Wildlife Service biologist on the last two.

In the following report, the account of the first three flights has been taken from charts and notes supplied by Mr. J. A. Aplin, of the California Division of Fish and Game. The last two flights have been described by Mr. Osgood R. Smith, Biologist, Division of Fishery Biology, Fish and Wildlife Service.



The blimp took off from Moffett Field early on the morning of October 14 and was off Point Arena at daybreak. It headed west for 50 miles and then came in because of high winds. It flew back and forth between Gualala and Tomales Bay three times, paralleling the coast 10, 20, and 30 miles offshore, then continued southwesterly to the Farallon Islands and in near Point San Pedro. Whales, porpoises, and "fish signs" (flotsam) were observed north of Tomales Bay, and about 12 schools of fish were seen in Fish and Game Block 450, northwest of the Farallon Islands. These were reported to the industry by radio. A few boats from the Monterey fleet scouted in the area on the night of October 14, but they found only a few small schools that appeared to be anchovies.

On October 16, the blimp paralleled the coast between Point Reyes and Gualala; took one leg out 40 miles west of San Francisco and back, and another out 25 miles west of Point Montara. No fish were sighted.

The blimp flew about 100 miles west from the San Francisco lightship on October 17, then back to Point San Pedro; out about 50 miles west from Half Moon Bay and back, then out about 40 miles southwest of Point Ano Nuevo and in to Monterey Bay. Eight whales were sighted about 20 miles off Pigeon Point, and "signs of fish" were seen off Monterey Bay, but no fish were sighted.

On October 18, the blimp headed out to sea over Santa Cruz, continuing about 40 miles westward. From there it paralleled the coast 35 or 40 miles up to Point Arena, then turned and followed the coast back to Point Montara, staying about 8 miles off. A few whales and sea lions were seen north of the Farallon Islands, but no fish were sighted.

The blimp flew 150 miles out to sea due west from Pescadero Point on October 28, then in towards Point Reyes and northerly to Point Arena, staying 20 to 30 miles off the coast. From Point Arena it followed the coast line back, staying about 6 miles offshore, then over to the Farallon Islands and southeasterly to Pescadero Point. On the long seaward leg nothing was sighted, not even bits of kelp, but after approaching Point Reyes, bits of kelp and other flotsam became rather common. On the return trip from Point Arena, several dozen fish schools were spotted near Russian River, about 6 miles offshore, and a few more schools, perhaps a dozen, were seen between the Farallon Islands and Point Montara. The schools appeared as purple, brown, or even brick red, spots of various shapes. Off Russian River and southeast of the Farallon Islands, humpback whales, sea lions, and birds were associated with the fish schools.

The schools were identified as sardines, and their presence reported by radio to the industry, both in San Francisco and Monterey. A few boats scouted for these fish on the 2 nights following the report, but found nothing.

On all of the flights, scouting was done from an altitude of about 1,500 feet, and visibility was excellent. The fish seen on October 28 showed up well at 1,500 feet, but could not be located when the blimp came down to a few hundred feet.

The Biology of the Soupfin

A report has recently been issued by the State of California, Division of Fish and Game, Bureau of Marine Fisheries, on the soupfin shark. It is Fishery Bulletin No. 64 entitled "The Biology of the Soupfin and Biochemical Studies of the Liver."

The report treats the subject in a most comprehensive manner. The following subjects are covered: The Soupfin Shark and the Fishery; The Relation of the Biology of the Soupfin to the Liver Yield of the Vitamin A; Determination of the Percentage of Oil in the Soupfin Shark Liver; Determination of Vitamin A in Soupfish Shark Oils; Stability of Vitamin A in Whole Shark Liver.

Copies of this report may be obtained by writing to the Department of Natural Resources, Division of Fish and Game, Bureau of Marine Fisheries, Ferry Building, San Francisco, Calif.

Purchases of Fish by Department of Agriculture

October 1946 purchases of fishery products by the U.S. Department of Agriculture totaled $5,418,412. Canned salmon purchases alone amounted to $5,371,885 and were largely responsible for the increase of $4,580,579 in the month's total purchases compared with September. From January 1 to October 31, 1946, total purchases reached $11,284,277.

Purchases of Fishery Products by USDA

Commodity	Unit	October 1946		January-October 1946	
		Quantity	F.O.B. Cost	Quantity	F.O.B. Cost
FISH			Dollars		Dollars
Fish, ground, canned	Cases	-	-	229,000	794,000
Herring, "	"	-	-	12,688	77,565
Mackerel, "	"	-	-	48,117	414,760
Pilchards, "	"	11,091	47,227	182,298	686,083
Salmon, "	"	370,065	5,371,185	711,922	9,238,432
Sardines, "	"	-	-	15,929	73,437
Total	"	381,156	5,418,412	1,199,954	11,284,277

Wholesale and Retail Prices

Wholesale prices for all foods showed a decline of 5.1 percent from mid-August to mid-September, while retail prices for all foods advanced 1.7 percent for the same period, according to reports from the Bureau of Labor Statistics, Department of Labor. Average retail prices of fresh and canned and fresh and frozen fish rose 0.1 and 1.8 percent, respectively, during the period. The retail price of pink salmon declined 6.0 percent and that for red salmon, 3.5 percent between August 13 and September 17, 1946.

Wholesale and Retail Prices

Item	Unit		Percentage change from--	
Wholesale: (1926 = 100)		Sept.14,1946	Aug.17,1946	Sept.15,1945
All commodities	Index No.	121.7	- 5.1	+16.2
Foods	do	128.1	-14.0	+22.5
		Sept. 1946	August	Sept. 1945
Fish:				
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	2.438	+12.5	+23.7
Red, No. 1, Tall	do	4.570	+12.4	+23.7
Cod, cured, large shore, Gloucester, Mass.	$ per 100 pounds	13.50	0	0
Herring, pickled, N. Y.	¢ per pound	12.0	0	0
Salmon, Alaska, smoked, N. Y.	do	35.0	0	0
Retail: (1935-39 = 100)		Sept.17,1946	Aug.13,1946	Sept.18,1945
All foods	Index No.	174.1	+1.7	+24.9
Fish:				
Fresh and canned	do	237.8	+0.1	+ 8.2
Fresh and frozen	¢ per pound	40.8	+1.8	+10.8
Canned salmon:				
Pink	¢ per pound can	24.0	-6.0	- 2.8
Red	do	41.7	-3.5	+ 4.5

PACKAGING

Interest in the pre-packaging of food products will be intensified in 1947. Many retail food store operators and some wholesalers and shippers have been carrying on experimental operations in this field. Shortages of materials and equipment have interfered with the rapid introduction of most new merchandising developments during the past few years. Easing of these shortages will permit adoption of proved practices.

The sale of pre-cut and packaged fish, both fresh and frozen, has been increasing in recent years, and this method of merchandising is expected to expand, especially when supplies of materials become plentiful and the market again becomes highly competitive.

--Fishery Leaflet No. 215

FOREIGN FISHERY TRADE

Imports and Exports

GROUNDFISH IMPORTS: From January 1 to November 30, 1946, there were 46,874,562 pounds of fresh and frozen groundfish imported into the United States under the tariff classification, "Fish, fresh or frozen fillets, steaks, etc., of cod, haddock, hake, cusk, pollock, and rosefish." This was 8,128,549 pounds more than the groundfish imports for the corresponding period in 1945, according to a report from the Bureau of Customs, Treasury Department. The reduced tariff quota for the year is 20,380,724 pounds.

Commodity	Nov. 1-30, 1946	Oct. 1-31 1946	November 1945	Jan. 1-Nov. 30, 1946	Jan. 1-Nov. 30, 1945
Fish, fresh or frozen fillets, steaks, etc., of cod, haddock, hake, cusk, pollock, and rosefish	3,024,902	6,803,251	2,898,420	46,874,562	38,746,013

Canada

COLD STORAGE: Canadian holdings of fishery products totaled 43,111,000 pounds on December 1, according to a report received from the Department of Trade and Commerce, Dominion Bureau of Statistics. Compared with stocks held on November 1, this was a decline of 1,211,000 pounds, but was 9,320,000 pounds greater than December 1, 1945.

France

ASDIC USED TO DETECT FISH: French Naval authorities collaborated with the Scientific and Technical Office for Maritime Fisheries on a mission prior to August 1946 to test the detection of fish through the use of asdic, according to a report dated August 5 to the Department of the Navy from the U. S. Naval Attache at Paris, France.

The correspondent who was aboard the ship on the mission reported the experiment as a success and conclusive. The fish were properly reported by the asdic operators.

According to the Naval Attache's report, a French mission conducted under water sound tests near St. Pierre et Miquelon as early as 1926 and found that echoes could be obtained from banks of fish. The Office, in collaboration with Professors Langevin and Florisson, continued its investigations from 1926 to 1939, always through the use of echoes obtained from sound apparatus.

Greenland

GREENLAND'S FIVE-YEAR FISHERIES PLAN: Work to be carried out in Greenland during the next 5 years with regard to the fishing industry has been outlined from a report of the discussions between the Greenlandic Delegation, the Danish Parliament's Greenland Committee, and officials from the Greenland Office and transmitted to the U. S. Department of State by the American Consulate at Godthaab, Greenland, under date of August 1, 1946.

The outline of the 5-year plan is, in part, as follows:

The Committee recommended that more and larger boats be sent to Greenland, and that they be paid for by the Greenlanders. It was pleased with the Greenland Office's plans for establishment of a boat works in Greenland.

The Committee emphasized the importance of the Greenland Office's practice of renovating and enlarging old fish houses and building new ones as the need arose.

The Greenland Office's policy of assigning young men with knowledge of fishing and interest in the promotion of the industry as outpost managers, at those places where the population is in need of instruction, was endorsed.

The Committee endorsed drying fish when lack of salt or other reasons prevents the purchase of fish for salting. A recommendation was made that enough fish be dried to provide for the internal requirements of the island.

With regard to frozen fish, the Committee agreed with the Greenland Office that nothing should be done at present. This stand was taken not only because of the large initial expenditure for the purchase and installation of required equipment, but because of the desire to see how successful the freezing process will be in other parts of the world.

The salting of salmon was approved and the recommendation made that it be continued as long as salmon prepared in this manner brought good prices. If this situation changed, it was thought that canning should be considered.

It was recommended that shrimp fishing be expanded as much as possible and if necessary new canneries be established. At present there is one cannery which is located at Holsteinsberg.

A recommendation was made that results of investigations now taking place on commercial possibilities of red fish be known before any decision is made.

Considerable shark fishing is being done in Greenland, which was approved. The skins bring a good price, and in order to create all possible interest, the Greenland Office has increased the price paid Greenlanders for good skins. It was suggested that possibilities for commercial use of shark liver oil be thoroughly investigated.

The group endorsed the Greenland Office's ruling that the head of the Arctic Station at Godhavn should make a close study of sea mammals, with special attention to their protection during the mating season, his primary mission.

It was proposed that an effort be made through international organizations to protect rookeries of the sortsiden and bladder nose seals, which are of such importance to the Greenlanders.

Ireland

HERRING OIL AND MEAL: Announcements issued by the British Government on October 8, 1946, concerning the production of herring oil and meal in Eire were transmitted to the U. S. Department of State on October 31, 1946, by the American Embassy at London, England.

Extracts from the announcements follow:

Arrangements have been made for processing surplus herrings into oil and meal during the coming East Anglian season.

A Committee of Inquiry, on which the Ministry of Agriculture and Fisheries and the Herring Industry Board are represented, is examining the possibilities, both from the short-term and long-term views, of developing the production of oil and meal from herrings in Eire. The Herring Industry Board has, during the recent Scottish season, operated a small plant in the Shetland Islands, and the present project involves the use of existing processing plants at Hull and London. The quantity of herrings that can be processed is necessarily limited by the capacity of these plants--about 4,000 crans (1,568,000 pounds) a week. If this capacity is completely used during the East Anglian fishing season, the production will be approximately 60 tons of oil, and 120 tons of meal a week.

The costs of processing and transporting the herrings from the landing ports to the plants would make the commercial price payable to fishermen for herrings unremunerative. The Government, therefore, in view of the shortage of oil and feeding stuffs, has offered, during the East Anglian season, a subsidy on herrings sold for processing. Only herrings which are not taken for the home or export markets will be sold for processing.

It is hoped that similar arrangements may be concluded for herring processing during the winter fishing season in the Firths of Clyde and Forth, in which case, use might be made of the existing plant at Falkirk.

The Committee of Inquiry is also examining the possibility of other developments of a long-term nature in utilizing herrings for oil and meal, but these plans are as yet only at a preliminary stage.

Netherlands

NETHERLANDS OYSTER INDUSTRY: The Netherlands oyster production this season is on the increase, and its exports of mussels are again rising. Its lobster fishing is relatively unimportant, but shrimp production is widespread, according to an article on the Netherlands fishing industry, prepared for the Commercial Intelligence Journal, December 7, 1946 (Ottawa, Canada), by the Commercial Counsellor of the Canadian Embassy.

Extracts from the article follow:

Oysters constitute one of the more important items in the Netherlands fishing industry. Centered in the Province of Zealand since 1870, the oyster industry has experienced periods of sharp fluctuations. About 1910, when the situation was extremely favorable, exports alone amounted to between 40 and 50 million oysters, while the anticipated production for the year 1946-47 is only 20 million.

After an interruption during the first world war, there existed another boom condition as a result of disease developing in the English and French oyster beds, causing a considerable demand for fresh supplies of breeding stock. Large quantities of breeding stock were shipped to France and other countries. In 1930, however, a serious oyster disease broke out in the Dutch breeding beds, causing great damage. Production figures fell yearly until 1936, when the total production amounted to only 6 million oysters. By securing breeding oysters from France, it was possible to improve the stock.

Another misfortune befell the industry in the winter of 1939-40. A very severe winter killed many of the French breeding oysters and wrought havoc among the depleted oyster beds. Due to the war, it was impossible to obtain new breeding stock, causing oyster production to fall to a very low level. Annual shipments during the 1941-44 period averaged only 4 or 5 million oysters. Owing to the great demand, high price, and limited supply, it was feared that light oysters would be harvested and sold, a situation which would have an additional adverse affect on the rapidly declining oyster production. A minimum weight was established for oysters that were to be sold.

During the last few years, production again has shown an increase, and in 1944-45 amounted to 8 million. Due to transportation and other difficulties, only 5 million could be sold, the remainder being resown in the oyster beds. During the 1945-46 season, about 15 million were sold, a figure which had not been reached since 1933-34.

Great Britain formerly was the principal consumer of heavy oyster varieties, while Belgium was the main purchaser of the lighter kinds. Belgium, at present the largest consumer, purchased 9 million, while 350,000 were sent to Denmark. Exports were also made to Switzerland, Sweden, and Luxembourg.

The Province of Zealand is also the center of the mussel industry. During the 1930-39 period, annual production amounted to between 40,000 and 50,000 metric

tons. Compared with exports, the prewar domestic consumption of mussels was very small, approximately 3 to 4 percent of the total production. In 1930, exports amounted to about 33,000 metric tons, rising in 1937 to 47,000 metric tons, the principal customers being Belgium and France.

Domestic mussel consumption assumed large proportions during the war. Exports to France ceased and those to Belgium declined strongly. From September 1945 to April 1, 1946, 8,000 metric tons were exported, the main purchaser being Belgium. It is estimated that between 30,000 and 40,000 metric tons will be available for export during the 1946-47 season.

Anchovy fishing is another fairly important Netherlands occupation. During the period 1878-1941, the average annual production was approximately 1,500 metric tons. Since 1930, exports of salted anchovies have fallen. Germany consumed nearly all the anchovies exported. Before the war, fairly large quantities of anchovies came from Spain, where Dutch dealers had established their own plants. These anchovies were processed in Holland for export, as the method of salting was different from that employed in Spain.

Not more than a few thousand kilos of lobsters are caught in the Netherlands annually. Efforts have been made to raise the production artificially, but these have proved unsuccessful due to the high cost. At the present time, the lobster trade is very small, but it is expected that business will improve.

The Netherlands shrimp fishing industry, with a fleet of 300 vessels, is not centered in any particular district, but is spread over various parts of the country. The average annual prewar catch was 2,836 metric tons. In 1945, more than 2,000 metric tons of shrimps were caught, of which 440 metric tons were destined for fodder and the balance largely marketed unscaled, due to the lack of labor. Exports are made to Belgium and Great Britain. It is expected that the latter will purchase at least 20 metric tons monthly for the next few months and that further shipments will be made to France and Sweden.

With regard to postwar prospects, exports, in general, are showing a steady increase, although various difficulties are encountered, in addition to competition from Norway and Denmark. With a view to the future, it is important that the industry should maintain an outlet in the British market, even though prices obtained in Great Britain are lower than those prevailing in the domestic market. Fresh fish has been included in the recent trade agreements with France and Czechoslovakia. Exports to Switzerland are somewhat handicapped by transportation difficulties.

Norway

WHALE AND HERRING OIL: The Norwegian whaling industry plans to operate 10 floating factories and 90 whalers by October 1947. Seven floating factories, one land factory, and 63 whalers are now operating.

Further forecasts of the whale-oil and herring-oil industry in Norway during 1947, published in Foreign Commerce Weekly, December 14, 1946, are in part, as follows:

It was reported in October 1946 that all of last season's exportable surplus products plus the preceding year's carry-over had been sold. The Norwegians expected a quota of 16,000 blue whales from the International Whaling Conference held in Washington.

Of Norway's total production of 83,615 tons of whale oil, more than 40 percent has been set aside for the home margarine industry, and before the year's end, Norwegians will have consumed over 34,000 tons of whale fat. Improved methods of refining and hardening have made today's margarine--which incidentally is about 80 percent whale oil--a far cry from older butter substitutes using the same product, says the Norwegian Information Service. Vegetable oils and butter, both of which served to add to the fat content of prewar Norwegian margarine, have been so limited that without resources of whale oil a serious edible-fat shortage might have developed in the northern kingdom. An increasing number of uses for both fish oils and whale oils are being found in Norway at the present time.

Herring-oil production during the 1946 season was reported to have been 14,500 metric tons. Next season's production is being estimated at from 9,000 to 10,000 metric tons. The difference between production last year and probable production this season is explained by the fact that the unusually good catch and high oil content of the herring last year cannot be expected this year.

Peru

IMPORTANCE OF FISHING INDUSTRY: The fishing industry plays an important role in the economy of Peru. It not only provides food, but a considerable number of people derive their living from it. In view of the shortage of domestic livestock for meat, a situation which is expected to continue for several years, fish is an important item in the national diet. The establishment of fish canneries in recent years, the projected installation of new fish-processing plants and cold-storage plants especially designed for fish, and the construction of larger fishing fleets are evidences of the impetus given this enterprise by increased domestic and foreign demand. The industry promises to become one of the most important in the economy of the country.

The foregoing is an extract from a report dated October 21, 1946, to the U. S. Department of State from the American Embassy at Lima, Peru. The report is in part as follows:

Although fishing has been carried on in Peru for many years, no industry worthy of the name existed until about 1941. Prior to this time, the main purpose of fishing in Peru was to supply fresh fish to the population along the coastal belt, and no serious attempt was made to process fish, except for small scale drying and salting operations in northern Peru. It was during World War II that the Peruvian fishing industry attained significance. United States' interest in fish livers in 1942-44 and the cutting off of Peru's regular sources of supply of fishery products resulted in an active interest by Peru in the processing and exportation of fish and fishery products. Active demand in the United States for Peruvian salted fillets, canned fish, and other fishery products has been directly responsible for the development of fishing activities in Peru in recent years.

There are 32 ports in Peru which are fish production centers. The most important are Callao, Sechura, Pisco, Pimentel, Ilo, and Huacho. Available statistics reveal that of a total catch of 31,958 metric tons in 1945, the port of Callao accounted for 14,074 metric tons, or 44 percent.

The most important fishing areas in Peru are within a radius of 120 miles of Callao, Sechura, Ilo, Pisco, Chimbote, and Cabo Blanco. Most of the fish at these points are found relatively close to shore, approximately 30 miles within the 100-fathom curve.

There are no organized commercial fresh-water fisheries in Peru. Fresh-water fishing, principally for Paiche (Arapaimas gypas) in the Amazon, trout in Lake Titicaca, shrimp in the rivers of the coast, and frogs in the Junin lakes is carried on both for subsistence and commercially.

The Bureau of Fisheries estimates that there are approximately 8,000 fishermen in Peru. It is estimated by the same source that there are approximately 1,000 persons employed in the fish-canning industry, 500 engaged in salting fish, and another 1,000 in the transportation of fish and other activities related to the industry.

During the bonito season, from October through March, fishermen make from 70 to 140 sailings. The average for Callao is reported as 105. Those engaged in hook fishing make an average of five sailings per week. In the northern part of Peru, fishermen remain at sea for long periods of time, up to 30 days, fishing and salting on board. Nearly all other Peruvian fishermen average 16 hours per round trip.

Peruvian bonito canneries average 8 working hours per day. Since most of these are modern factories, working conditions are good. Working rooms are clean, well ventilated, and, as a general rule, no artificial light is necessary.

Subsistence fishing is carried on in the coastal region on a small scale, and in rivers and lakes located in the Amazon and Andean regions, where the population, composed mostly of Indians of very low income, rely to a large extent on fresh-water fish for food.

It is estimated that about 2,000 persons fish for sport in Peru. Although sport fishing is not organized in this country, expansion is anticipated in the near future, particularly angling for large fish such as swordfish and albacore.

It is estimated that there are approximately 2,600 fishing vessels of all types in Peru, including five boats 35-40 feet long, especially designed

BALSA BOAT ON LAKE TITICACA

for shark fishing, and six purse-seiners. Sail fishing boats are by far the most numerous. The great majority of these are 18 to 25 feet long and have a cargo capacity of from ½ to 2 metric tons. Small power fishing boats range in length from 27 to 34 feet. Most of them are 29 feet long with a beam of from 9 to 11 feet and a cargo capacity of from 2½ to 5 metric tons. It is estimated that there are at present about 250 boats of this type, most of which are equipped with 7-15 hp. semi-diesel or gasoline engines.

In view of the increasing requirements of processing plants, the present fishing fleet is inadequate. In order to obtain a twofold increase in the bonito catch, which is considered necessary to satisfy the demands of Peruvian fish canneries, the construction of boats larger than most of those now in use will be required.

There is a scarcity in Peru of certain kinds of fishing gear. Most needed are cotton twine for nets, hooks, half-ring nets, and small purse-seines for use by small boats. It is reported that a plant has been established for the manufacture of cotton twine for fishing and other purposes.

So far no offshore fishing has been done in Peru. Practically all fishing boats operated in Peru are of a type suitable only for inshore fishing, with the exception of two or three vessels.

During the summer season, gill nets are used almost exclusively for bonito fishing, while in the winter, trolling, using oars as booms, is more common. Gill nets are used for fishing herring and mackerel, and hooks are used for fishing tuna, drum, and bass. Other fishing gear widely used in Peru are trammel nets, haul seines, trawl lines, and hand lines.

The statistics show that the total Peruvian fish catch was 31,958 metric tons in 1945; 30,268 metric tons in 1944; 26,725 metric tons in 1943; and 21,063 metric tons in 1942. Bonito accounted for 18,711 metric tons (59 percent) of the total 1945 catch, as against 16,327 metric tons (54 percent) in 1944; 11,967 metric tons (45 percent) in 1943; and 5,718 metric tons (27 percent) in 1942. The 1945 total catch was 52 percent greater than in 1942. Bonito landings in 1945 increased 228 percent over 1942. Other species whose 1945 catch was 500 metric tons or more were mackerel, sea bass, drum, dogfish, and herring.

Although statistics on the Peruvian fish catch are available from 1939, figures compiled before 1942 were very inaccurate and are misleading.

The production of fresh salted fish fillets in 1945, most of which was bonito, is estimated to have been about 7,000 metric tons, practically all of which was exported to the United States. This industry was stimulated by the purchases of agencies of the United States Government during the war. The ces-

sation of purchases by the United States Commercial Company and UNRRA in the latter part of 1946 probably will result in the termination of production of salted bonito fillets, since there is practically no demand for this product in Peru.

The total production of canned fish in Peru in 1945 was estimated at about 275,000 cases of forty-eight ½-pound tins, and 25,000 cases of forty-eight 1-pound tins. Bonito in oil (cottonseed oil sometimes mixed with peanut oil) is the principal fish canned in Peru. It is packed in ½-pound tins and is generally designated as tuna fish, although the amount of tuna fish canned is very small. Tuna fish landings in 1945 amounted to only 295 metric tons, or less than 1 percent of the total landings of fish. Reliable trade resources and the Bureau of Fisheries estimate that the total output of canned bonito and tuna fish in oil during the year 1945 was approximately 250,000 cases of forty-eight ½-pound cans.

The 1945 production of canned sardines in tomato sauce, principally herring and mackerel, was calculated roughly at 25,000 cases of forty-eight ½-pound tins. Sardines in oil are not being packed at present in Peru.

"Bonito al natural" (in brine), packed in 1-pound cans, is another type of fish prepared in Peru. The output of this product in 1945 was estimated at about 25,000 cases of forty-eight 1-pound cans.

The total production of dry salted fish in Peru in 1945, excluding the output of salted fresh-water fish, which is unknown, is estimated at approximately 3,000 metric tons, of which about 1,000 metric tons were salted shark and swordfish, locally known as codfish, and the balance was miscellaneous species.

So far, no smoked, kippered, or pickled fish have been produced in Peru, but local concerns plan to produce such products in the future.

Although fish meal has been produced in Peru since 1945, the extraction of fish oil was begun on a small scale only, in 1946. The production of meal and oil is rather sporadic, depending upon the availability of fish and fish residues. As a general rule, only fish residues from the filleting industry are used for this purpose. At present, there are only three reduction plants which are producing fish oil.

Fish livers have not yet been utilized in Peru for the production of vitamins, but a Peruvian-American organization is now building a plant for the processing of fish livers, which is expected to be completed by the end of 1946.

The only available statistics on fresh fish consumption in Peru are those for bonito for the Lima-Callao area which are compiled by the Bureau of Fisheries. According to these data, of a total bonito catch of 12,514 metric tons in Callao during the year 1945, 4,137 metric tons, or 33.1 percent, were consumed fresh. The balance of 8,376 metric tons, or 66 percent, was used by fish processing plants.

There is a definite preference in Peru for fresh fish. There is a fairly good demand for canned fish, particularly sardines in olive oil and salmon. Dried salted codfish is in demand particularly during the Easter season, when, for religious reasons, a great number of persons abstain from eating meat and poultry. On the other hand, there is practically no demand in this market for fresh salted or frozen fish fillets.

In prewar years, fairly important quantities of fish and fishery products were imported into Peru. Sardines, salmon, and dried fish were the principal items.

The first fish was exported from Peru on a commercial scale in 1940. In this year, 93,000 gross kilos of frozen fish were shipped to the United States. Exports of fish livers, dried, salted bonito fillets, and canned bonito increased steadily as a result of active United States demand.

Despite the development of the domestic fish processing industry, Peruvian import duties on fish and fish products have not been changed since 1936, except for an increase of 20 percent in December 1941, which was a general increase in the Peruvian tariff rather than a measure to protect the local industry.

Prices for fresh fish vary in Peru according to production centers and the supply, which is seasonal. Municipalities are given the authority to fix prices on fish in accordance with size, weight, and type of fish.

The Bureau of Fisheries and other reliable sources are of the opinion that the production of fish and fishery products in Peru will increase substantially in the near future as a result of the establishment of new processing plants. The fish canning industry is expanding so rapidly that the processing capacity at present is greatly in excess of fish supplies, and canneries must operate sporadically. The increasing demand for fish in the Lima-Callao and adjoining areas has intensified fishing activities at nearby northern ports--Huacho, Chancey, Supe, and Chimbote--and the establishment of new processing plants in these places has been reported. In addition to the plants in the port of Pisco, there is a new fishing plant operating in the port of Ilo, in the extreme south of the country. It is expected that as soon as highway, fresh water supplies, electric power, and other necessary facilities are improved in the northern section (Paita-Sechura-Cabo Blanco) fishing activities will expand considerably, inasmuch as this is regarded as one of the best fishing areas in Peru.

It is estimated that, at present, almost half of the annual Peruvian fish catch, calculated at approximately 30,000 metric tons, is available for export in processed form, a quantity which should increase as fishing activities are intensified.

Despite the planned local utilization of fish livers for the production of vitamins and related medicinal products, it is considered that fairly important quantities of livers will be available for export. The outlook is promising, particularly for crude fish oil, the industrial application of which is very limited in Peru, both because of quality and price considerations and because Peru is a cottonseed oil producer. The small quantities of fish meal turned out at present are needed in the country in view of the scarcity of feedstuffs and fertilizers. Unless the fish meal output is increased substantially, there will be little for export.

FEDERAL LEGISLATION, DECISIONS, ORDERS, ETC.

Department of Agriculture

FATS AND OILS: The United States expects to schedule for import approximately 240 million pounds of fats and oils and to schedule for export approximately 138 million pounds of fats and oils during the first quarter of 1947, the Department of Agriculture announced on December 30. This is on the basis of the International Emergency Food Council recommendations for the international distribution of fats and oils during the first quarter of 1947. This is the first time since 1942 that the United States will be on a net import rather than a net export basis.

No recommendations for the international distribution of fats and oils during later quarters of 1947 were made by I.E.F.C., although it announced its intention to promulgate such recommendations prior to the beginning of the second quarter.

Exports of fats and oils from the United States, contemplated under this program, would consist principally of lard, soybean oil, shortening, margarine, and soap, together with relatively small quantities of other fat and oil commodities. Imports into the United States would consist principally of copra (for crushing into coconut oil), linseed oil, castor beans and oil, and smaller quantities of tung, rapeseed, and other oils.

* * * * *

IMPORT CONTROLS: The Department of Agriculture, on December 24, announced the removal of controls on the importation into the continental United States from all countries of pickled or salted cod, haddock, hake, pollock, and cusk. This action was taken in Amdt. 18 to WFO-63, effective December 24, 1946. The Department explained that quotas have been established and import licenses issued for almost all the United States allocation of these fishery products for the 1946 pack year. Export controls in producing countries are now sufficient to warrant removal of United States import restrictions, officials said.

Importation of various pickled, salted, and canned fish has been restricted since early in the war, but controls are being lifted gradually in line with world-wide conditions. With this amendment in effect, the following classes of fishery products remain under import control:

Canned salmon (not in oil, or in oil and other substances)
Sardines (in oil, or in oil and other substances)
Canned sardines and other herring (including snacks, tidbits, rollmops, and sprats)
Herring (canned, smoked, kippered, or in tomato sauce)
Tuna fish (in oil, or in oil and other substances)
Other canned fish (in oil, not in oil, or in oil and other substances)

A license obtained from the Department of Agriculture is required for the importation of any of these items from all countries except Norway.

Civilian Production Administration

TINPLATE: The removal of all tinplate controls which previously had channelled the major portion of tinmill output into the production of cans for essential and perishable food was announced by the Civilian Production Administration on December 24. The amendment to M-81 became effective December 27.

This action permits the use of cans for packing shortening, coffee, beer, pet foods, and a number of other food products previously banned under the order. Non-food products for which tinplate is now permitted on an unlimited basis, as compared with a former quota basis, include turpentine, polishes, shellac, waxes, paints, liquid soap, roofing cement, etc.

CPA explained that this is the slack period in the food-canning industry and that the relaxation of the tinplate controls at this relatively early date in the 1947 food-packing season would give canners ample opportunity to make arrangements for their spring tinplate deliveries.

Remaining unchanged in Order M-81 are the restrictions which regulate the amount of tin coating to be used in tinplate for cans, and also the restrictions regulating the sizes of tin containers. These controls were retained, CPA said, because they offered the best methods of conserving pig tin, which is still in short supply.

Interstate Commerce Commission

FREIGHT AND EXPRESS RATES: All basic freight rates and charges of rail and water carriers may be increased by 20 percent, according to the Interstate Commerce Commission decision of December 6, 1946. These new increased rates will become effective upon the filing of new tariffs by the railroads during the period January 1 to February 28, 1947. Fish and fishery products follow the general rate increase allowed by the Commission. However, the increase in the rates for fish oil is subject to a maximum of 12 cents per hundred pounds, and, for the important group--canned fish--subject to a maximum of 13 cents per hundred pounds.

The rate increases will be somewhat higher in the "official territory" (including the territory between the Mississippi River, the Great Lakes, the Atlantic Coast, and the Mason-Dixon Line) for less than carload and "any quantity" traffic. In these cases, an increase of 25 percent within official territory and of 22.5 percent between official territory and points in other territories are permitted.

By a prior decision dated October 28, 1946, the Interstate Commerce Commission allowed increased express rates and charges amounting to 20 cents per hundred pounds.

RECENT FISHERY PUBLICATIONS

Listed below are informational publications which recently have been processed by the Division of Commercial Fisheries. FL publications are available, free of charge, from the Fish and Wildlife Service, Merchandise Mart, Chicago 54, Ill. Other listed publications may be obtained, also free of charge, from the Division of Commercial Fisheries, Fish and Wildlife Service, Washington 25, D. C.

Number	Title
CFS-301	Frozen Fish Report, November 1946
CFS-302	Fish Meal and Oil, September 1946
CFS-305	Maine Landings, September 1946
CFS-306	Frozen Fish Report, December 1946
CFS-308	Fish Meal and Oil, October 1946
FL-204	A Cardboard Smokehouse (formerly Sep. No. 141)
FL-205	A Field Method for Determination of the Oil Content of Fish Livers (formerly Sep. No. 98)
FL-206	Certain Aspects of the German Fishing Industry--Report I
FL-207	Same as FL-206 --Report II
FL-208	" " " --Report III
FL-209	" " " --Report IV
FL-210	" " " --Report V
FL-211	" " " --Report VI
SL-13	Wholesale Dealers in Fishery Products, N. C., 1946
SL-20	Wholesale Dealers in Fishery Products, Texas, 1945
SL-111	Firms Canning Clam Products, 1945

Reprints (Features) from Commercial Fisheries Review, November and December 1946.

Sep. No. 152 - Panama and Its Fisheries
Sep. No. 153 - A Sampler for Livers Frozen in Drums
Sep. No. 154 - Oyster Transplanting in Winter and Early Spring
Sep. No. 155 - Extension of Unemployment Insurance to Certain Fishing Services
Sep. No. 156 - Effect of Cooking on the Nutritive Value of the Protein of Cod
Sep. No. 157 - Gear Used in the Sea Scallop Fishery
Sep. No. 158 - Thiamine and Riboflavin in Baked and Simmered Oysters

Designations for fishery publications are interpreted as follows:

CFS - Current fishery statistics of the United States and Alaska.

SL - Statistical lists, consisting of lists of dealers of fishery products and manufacturers of byproducts.

FL-- Fishery leaflets.

MDL - Market development lists of frozen food locker plants and locker associations.

FISHERIES PRODUCTION, 1946

Although the 1946 fish production was not far below the 1941-45 average in volume, the year was marked by extremes of success or failure almost without parallel in the history of the fisheries. Rosefish and tuna exceeded all previous production records; the salmon pack was the smallest since 1927; the menhaden catch was the largest on record; and the pilchard fishery experienced the worst season in its history. The United States and Alaska fish catch in 1946 totaled 4.25 billion pounds.

--Fishery Leaflet No. 215

FISHERY STATISTICAL OFFICES

Location	In Charge	Telephone
W. Boothbay Harbor, Me., P. O. Box 33.	David A. McKown, Fishery Marketing Specialist	164 (Home)
Portland, Me., U. S. Customs House.	James P. Harris, Market News Aide	- -
Boston 10, Mass., Commonwealth Pier.	B. E. Lindgren, Fishery Marketing Specialist	LIberty 1513
Gloucester, Mass., Rm. 205, P. O. Bldg.	H. Haberland, Fishery Marketing Specialist H. R. Marchant, Fishery Marketing Agent	3420
Provincetown, Mass., Rm. 201, P. O. Bldg.	Frank Freeland, Fishery Marketing Agent	868
New York 7, N. Y., 155 John Street.	H. M. Bearse & R. H. Wilson Fishery Marketing Specialists	HEekman 3-4382
Avon, N. J., Drawer D.	V. E. Heffelfinger, Fishery Marketing Specialist	Asbury Park 6837M (Home)
Weems, Va., General Delivery	James Wharton, Fishery Marketing Specialist	Kilmarnock 14F5 (Home)
Savannah, Ga., 2228 Forest Street.	C. B. Lowden, Fishery Marketing Specialist	3-3349 (Home)
New Orleans 16, La., 1100 Decatur Street.	Chas. H. Lyles, Fishery Marketing Specialist	MAgnolia 1674
San Pedro, Calif., Rm. 8, P. O. Bldg.	C. B. Tendick, Fishery Marketing Specialist	TErminal 2-5354
Seattle 1, Wash., 421 Bell St. Terminal	E. C. Hinsdale & Frank M. Wood, Fishery Marketing Specialists	MAin 0740
Astoria, Oregon, 1st Nat'l Bank Bldg.	H. W. Larson, Fishery Marketing Specialist	- -

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